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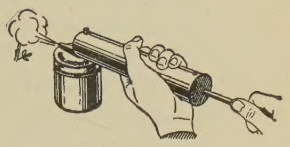

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[Kirichenko (A. N.).] **Кириченко (А. Н.). Ed. The San José Scale in Conditions of USSR. Works of Quarantine Laboratories.** [*In Russian.*]—Demy 8vo, 272 pp., 15 graphs, 30 figs., 45 refs. Leningrad, Sel'khozgiz, 1937. (With Summaries in English.)

This work consists of nine papers recording the results of investigations in the Russian Union since 1932 on the distribution and bionomics of the San José scale, *Aonidiella* (*Aspidiotus*) *perniciosa*, Comst.

In Bio-ecology of San José Scale in Conditions of East Georgia (pp. 5–46), T. V. Timofeeva states that it was imported into the western part of eastern Georgia from Sochi (on the Black Sea coast) with nursery stock in the winter of 1929–30, and by 1934 had spread over about 70 acres, infesting apples and, to a less extent, cherries and peaches. Only the first-instar larvae survive the winter. They resume activity in April and become adult in May. Young of successive generations are produced from mid-June till early August, from early August till early October, and from mid-October till the end of December. Some 30 per cent. of the larvae of the first generation that appear at the end of July or beginning of August undergo a summer diapause, and of these some 12 per cent. enter hibernation. Of the first-instar larvae of the second generation produced in August, about 39 per cent. diapause, and of these 25 per cent. enter hibernation, together with all those that appear at the end of September or beginning of October and all of the third generation. The average numbers of larvae produced by the females of the overwintered and first generations were 57 and 85, respectively, as compared with only 6 in the case of the second generation. Mortality of the scales from natural causes averaged 46 per cent. on trees with broken and dying bark and only 10 per cent. on those with undamaged bark. The local Coccinellid predators, *Chilocorus bipustulatus*, L., and *C. renipustulatus*, Scriba, and the parasites, *Aphytis* (*Aphelinus*) *mytilaspidis*, LeB., and *Anagrus* sp., occur in small numbers and are of no practical importance.

A. A. Gerasimova in Bio-ecology of San José Scale in Conditions of Adjaristan (pp. 47–65), reports that it is common near Batum and in a district to the north on peach, plum, mandarin orange and lemon. It has three complete generations a year and a partial fourth. Maximum fecundity was observed in the case of the females of the second generation, which produced as many as 165 larvae on peach and 194 on plum. In 1934 and 1935, mortality from natural causes averaged 27·2 per cent. for all generations; about 10·8 per cent. were destroyed by predators, including *C. bipustulatus* (which was the most important), *C. renipustulatus* and the ant, *Solenopsis fugax*, Latr., and about 5·7 per cent. were parasitised by Chalcidoids. The fact that rather more than 40 per cent. of the first-instar larvae of both the first and second generations diapause also somewhat checks the propagation of the scale. It is, however, gradually increasing in abundance and distribution. In experiments on artificial infestation of different plants, it developed successfully on *Prunus laurocerasus*, *Aleurites fordi*, persimmon (*Diospyros kaki*), and *Citrus trifoliata*, but not on tea, *Laurus nobilis* or camphor, *Cinnamomum* (*Laurus*) *camphora*.

A paper by G. F. Rekk, On the Injuriousness of San José Scale in Georgia (pp. 66–93), comprises an account of observations on the reaction to infestation of young apple, cherry and plum trees. It was found that the scale severely injures the bark, chiefly on the stem and main branches, being responsible for the dying of the tissues outside

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the cambium and the formation of cracks. The increase in the growth of the trees is reduced, the crown becomes thinner, fewer shoots develop, the yield of fruits is decreased, and their commercial quality is lowered. Slight infestation intensifies the activity of the cambium layer of the stems so that the latter increase in diameter, whereas severe infestation checks the expansion of the stem.

In Growth of Shoots of Fruit Trees infested by San José Scale (pp. 94–131), N. F. Snitko describes the character of the damage caused to apples and plums in the Azov-Black Sea Province and gives a detailed account of investigations on the thickness of infested and healthy branches of apples to determine the effect of infestation on the development of the trees. The feeding of the scale produces a disturbance in the normal function of the conducting system of the tree, which results in a marked decrease in the growth of the crown branches and sometimes in the size of the leaves. As a result of infestation, some of the branches become fruit-bearing, the yield of fruit increases for a time and then decreases, and the life of the tree in general and of its separate parts is shortened.

An account by A. I. Il'ina of Pathologo-anatomical Modification of Apple-trees damaged by San José Scale (pp. 133–146) is based on laboratory investigations.

In Importance of Fruits as a possible Means of Carriage of San José Scale (pp. 147–186), L. A. Skorkin records investigations carried out on apples. Field observations showed a direct correlation between the infestation of a tree and its fruit, so that the presence or severity of an infestation could be determined by the occurrence or abundance on the apples of red stains caused by the feeding of the scale. Under natural conditions, its rate of mortality on the apples is high, but it maintains itself and reproduces on stored apples in summer and autumn, and infestation spreads to healthy apples kept with them. In cooler stores the viability of the scales is lowered, and very few survive the winter, so that there is little danger of their distribution on apples transported in spring. The risk is greatest at the time when the greatest numbers of females are producing young, which was in September and October in the Sukhum district in 1935. Various observations showed that the crawling larvae cannot migrate for a distance of more than 2 ft. and cannot survive without food for longer than about 24 hours. Trees became infested, however, from apples placed at a distance of 18 ins. or less. It is pointed out that on apples the scale chiefly occurs in the hollows at the stem and calyx ends, which are usually discarded when the fruit is eaten and so might be thrown close to uninfested trees.

In Effect of Injury by *Aspidiotus perniciosus* Comst. on the Marketability of fresh Fruits (pp. 187–201), B. A. Smirnov discusses investigations in the Azov-Black Sea Province. The percentage of apples attacked ranged from 40 on slightly infested trees to 85–100 on severely infested ones, and their commercial value was decreased in proportion to the degree of the infestation of the tree.

In Fumigation of fresh Fruits by Hydrocyanic Acid Gas with a View to destroying *Aspidiotus perniciosus* Comst. (pp. 202–221), A. F. Belyavskaya gives an account of laboratory experiments in which hydrocyanic acid gas was generated from 85–96 per cent. sodium cyanide, used at the rate of 1 part by weight to $1\frac{1}{2}$ parts sulphuric acid and 3 parts water. The quality of the apples was not affected by fumigation, even when the sodium cyanide was used at rates of 4–4·4

oz. per 100 cu. ft. space, and 100 per cent. mortality of the scales on apples wrapped in paper and packed in wooden boxes was obtained by fumigating for an hour with 1·4 oz. at 22°C. [71·6°F.] or 1·7 oz. at 10°C. [50°F.]. The three varieties of pears tested were all scorched when the rate was 4 oz., and one even when it was 1·3 oz. The other two were slightly affected when the rate was 1·8 oz. After being aired for two hours, apples, pears and plums retained only negligible amounts of HCN (much less than would be dangerous to man), but cherries, strawberries and currants absorbed considerable amounts and therefore should not be fumigated. Fumigation at the rate of 2·2 oz. per 100 cu. ft. for one hour did not affect the ripening or keeping qualities of apples. Fumigating apples in large brick chambers with cemented walls and ceiling and a concrete floor, showed that effective rates of application for an exposure of one hour are 15 and 17 oz. sodium cyanide per 1,000 cu. ft. at temperatures in the open air of 20–25°C. [68–77°F.] and 10–20° C. [50–68°F.], respectively, provided that the fruit and the packing material are dry.

The final paper, The San José Scale under Conditions of the USSR (pp. 222–257), by A. N. Kirichenko, contains a review of its distribution in Europe, the Russian Union and the United States. In the Russian Union it was first found in 1931, and it is now common along the Black Sea coast of the Caucasus in the plain and at altitudes of up to 3,000 ft. Isolated foci of infestation have also been found in eastern and western Georgia. The spread of the scale is mainly due to its being carried by wind. Though the application of mineral oil emulsions markedly decreases the intensity of the infestation in localities where spraying is being carried out, the scale continues to spread slowly. Its economic importance is discussed, an account of its bionomics is given, and fumigation of the infested apple fruits is recommended to prevent its dissemination.

[Vasil'ev (K. A.).] **Васильев (К. А.). Apions as a Pest of Clover Seeds and their Control.** [*In Russian.*]—Demy 8vo, 96 pp., 16 figs., 40 refs. Moscow, Izd. Vsesoyuzn. Akad. s.-kh. Nauk Lenina, 1936. (With a Summary in English.) Price 2 *rub.* 75 *kop.* [Recd. March 1938.]

A detailed account is given of investigations carried out in 1932–35 in Bashkiria and the former Province of Ural on the bionomics and control of *Apion apricans*, Hbst., and *A. aestivum*, Germ., which are the most important species of the genus that attack red clover in the Russian Union. Oviposition begins in the second half of May, some 20–25 days before the flowering of cultivated red clover, reaches a maximum in mid-July and ceases in mid-August. The eggs are deposited in the buds and flower heads, and sometimes in the stems near the buds. The females invariably select for oviposition the most developed generative organs of the plant. The total number of eggs laid by a female in the insectary averaged 7·4 in 1933 and 11·4 in 1932. The duration of the egg stage varied from 7·8 to 3·3 days at mean temperatures of 12·1 and 17·8°C. [53·78 and 64·04°F.], respectively. The larvae are present from the beginning of June till September or even October, being most numerous at the end of July and the beginning of August, and the first pupae are found about the end of June. The larval stage averaged 26·5 and 22·1 days at mean temperatures of 19·3 and

23·1°C. [66·74 and 73·4°F.], and the pupal stage 8·8 days at 16·6°C. [61·88°F.] Pupation takes place in tunnels in the buds, stems or receptacles of the flower heads. Adult emergence continues till autumn. The overwintered weevils move about rapidly in search of places for oviposition, whereas the activity of newly emerged individuals is confined to feeding on the leaves. With the setting in of the cold, the weevils enter the upper layer of the soil or dry plant débris for hibernation, but resume feeding during spells of warm weather.

Spintherus linearis, Wlk., was responsible for 16·8–26·5 per cent. parasitism of the weevils in Bashkiria, mature larvae being observed from the last ten days in July in the pupal tunnels, together with remains of the host larvae and pupae.

The economic importance of *A. apricans* and *A. aestivum* is discussed at length. The young larvae do not injure the buds to such an extent as to impede their development, and investigation showed that the damage is confined to the loss of some of the seeds in the infested clover heads. The author estimates that the loss is equivalent to about 16 per cent. of the seeds in Bashkiria and about half this percentage in the Province of Ural, and concludes that the common practice of mowing seed clover for hay because the flower heads are severely infested is not justified. Various dust insecticides proved ineffective for practical use; the weevils avoided the treated foliage if clean foliage was available, and it is impossible to keep the plants covered under field conditions. A mortality of 80·5–99·3 per cent., after 2 hours, of the young weevils near stacks of mown clover in which they had completed development was obtained in August by spraying round the ricks with 20 per cent. kerosene emulsion at the rate of 1 gal. to 10 sq. yards. It is thought that effective control would be obtained if this spray was applied once every few years, and no clover was left for seed in the year of treatment. This would involve the cutting of first and second year clover about the end of June and again in August, as in experiments this gave 72·7–97 per cent. mortality of eggs and young larvae and 5·5–27·3 per cent. of pupae and mature larvae, and spraying the space round the ricks after the second cut.

[Berezhkov (R. P.).] **Бережков (Р. П.).** *Loxostege sticticalis* **L. in der Waldzone Westsibiriens.** [*L. sticticalis* in the Forest Zone of western Siberia.] [*In Russian.*]—*Trav. Inst. sci. Biol. Tomsk* **2** pp. 98–131, 21 refs. Tomsk, 1936. (With a Summary in German.) [Recd. March 1938.]

A detailed account is given of the migrations of *Loxostege sticticalis*, L., in the forest zone of western Siberia in the years 1930–33, inclusive. The directions of the migrations were dependent on the prevailing winds and were entirely independent of temperature and humidity in the regions studied. Adults of the overwintered generation began to arrive in the environs of Tomsk in June from the south-western forest-steppe zone, travelling mostly along river valleys where the cultivated areas were greater. Females oviposited about three days after the flight, and the larvae developed at the same time in both northern and southern districts. Females of the first generation were sterile owing to the unfavourable local climatic conditions. Larvae of this generation did not diapause, and no overwintered cocoons were observed. They caused considerable damage to a wide variety of wild and cultivated plants, including hemp, flax, beet and clover.

SHIRAKI (T.). **Cotton Insects. Compendium of Insect and Fungous Pests of agricultural Crops in Formosa, No. 4.** [*In Japanese.*]—*Publ. Bur. Industr. Formosa* no. 801, 166 pp., 109 figs. Taihoku, Formosa, 1937.

Some 80 species of insects that occur on cotton plants in Formosa are described, and notes are given on their life-history and control. *Empoasca* (*Chlorita*) *biguttula*, Mats., is one of the most injurious and is particularly harmful to the early-maturing varieties and those with leaves that have few hairs. *Gossypium arboreum* is generally more resistant to this Jassid than *G. herbaceum*. The varieties with leaves that have a great number of ribs are more resistant to *Aphis gossypii*, Glov., which is not particularly injurious on the island. The other pests include *Platyedra* (*Pectinophora*) *gossypiella*, Saund., *Sylepta derogata*, F., *Pyroderces simplex*, Wlsm., *Pyrausta nubilalis*, Hb., *Brachytrypes portentosus*, Licht., and the Lamiid, *Sybra ordinata*, Bates, which attacks the bolls.

EGUCHI (M.). **Observations on *Aphis gossypii* Glov. and Results of Control Experiments.** [*In Japanese.*]—*Ann. agric. Exp. Sta. Chosen* **9** no. 3 pp. 379–416, 5 pls. Suigen, Korea, November 1937.

Aphis gossypii, Glov., is one of the most serious pests of cotton in Korea, where it also attacks *Hibiscus* spp., pomegranate (*Punica granatum*), cucumber, *Chrysanthemum*, *Portulaca oleracea* and other plants. All forms of this Aphid are described, and lists are given of its food-plants and natural enemies in Korea and Japan. Winter eggs laid on *Hibiscus syriacus* hatch in April and early May, and the first winged forms appear in early May and migrate to cotton. Some of the Aphids continue to breed on *Hibiscus*, producing winged forms at intervals, but they become very scarce on this plant in July and August. They are also less abundant on cotton in these months than they are in June and autumn. The optimum temperature for them is 18–23°C. [64·4–73·4°F.], and many are killed by the heat in summer. Winged males and wingless oviparous females appear from mid-October onwards, but they did not occur on cotton in a greenhouse during the winter. The maximum number of generations a year is about 33; on cotton there are about 28. A viviparous female produces 50–75 young at the rate of 5–7 per day, and a sexual female lays an average of 5 eggs. Natural enemies include a Chalcidoid parasite, the Coccinellid, *Coelophora inaequalis*, F., and spiders. Spraying cotton twice in June with a proprietary derris insecticide mixed with soap has been found very effective for control, and it is suggested that sprays of lime-sulphur should be applied in winter to trees on which the eggs are laid.

KUWAYAMA (S.). **Studies on *Lema oryzae* Kuwayama, the Rice Leaf-beetle, Pt. VII. Experiments with Stomach Poisons against the Rice Leaf-beetle.** [*In Japanese.*]—*Rep. Hokkaido agric. Exp. Sta.* no. 38 pp. 1–87, 2 pls. Sapporo, December 1937.

This account of further work on *Lema oryzae*, Kuway., on rice in Japan [*cf. R.A.E.*, A **25** 226] includes the results of laboratory and field spraying experiments with stomach poisons from 1931 to 1936. Lead arsenate, calcium arsenate [**24** 207] and calcium fluosilicate, all

with calcium caseinate as an adhesive were tested. Calcium arsenate was the most effective against the adults, and lead arsenate the least so against both adults and larvae. The effect of the two arsenates was more enduring than that of the fluosilicate. It is concluded that calcium arsenate gives the best control. It does not injure the rice plants in the early stages of cultivation, when the beetle attacks them. The formula recommended is 2 lb. calcium arsenate and 1 lb. calcium caseinate in 40 gals. water.

OKADA (I.). **Oviposition of** *Grapholitha glycinivorella* **Mats. in Relation to some Legumes. (Preliminary Report.)** [*In Japanese.*] —*Oyo Dobuts. Zasshi* **10** (1) pp. 8–17, 4 figs. Tokyo, February 1938.

Soy bean is the only plant attacked by larvae of *Cydia* (*Grapholitha*) *glycinivorella*, Mats., in Hokkaido and Manchuria, but in experiments in Manchuria, females oviposited, though less readily, on pods of *Lupinus perennis*. They did not oviposit on some other leguminous plants, and probably did so on *Lupinus* because its pods are hairy, as they are known to prefer the hairy varieties of soy bean [*cf. R.A.E.*, A **24** 788].

FUKAYA (S.). **On the Mechanism of Excretion in the last larval Instar of** *Acanthostoma insidiator* **Smith. (Ichneum.).** [*In Japanese.*]—*Oyo Dobuts. Zasshi* **10** (1) pp. 18–21, 3 figs. Tokyo, February 1938.

Near Tokyo, adults of *Acanthostoma insidiator*, Smith, which parasitises the Saturniids, *Dictyoploca japonica*, Moore, and *Antheraea yamamai*, Guér. [*cf. R.A.E.*, A **13** 547], emerge in June. Oviposition occurs soon after emergence, but the larvae mature in the larvae of *D. japonica* in February of the following year and pupate in cocoons in the host pupae in April. The larvae excrete in the last instar, and the posterior end of the full-fed larva or pupa is held in the excreta, covered with a membrane, when they become dry and hard. The adult parasite emerges normally even when the excreta are removed. Sometimes 50 per cent. of the host larvae are attacked, and up to 3 parasites may emerge from a single host.

SAITO (K.). **On the Oviposition and feeding Habits of** *Ithone mirabilis* **Motsch.** [*In Japanese.*]—*Oyo Dobuts. Zasshi* **10** (1) pp. 27–30. Tokyo, February 1938.

The Coccinellid, *Aiolocaria* (*Ithone*) *mirabilis*, Motsch., feeds on the eggs and larvae of *Melasoma vigintipunctata*, Scop., *M. populi*, L., and *M. adamsi*, Baly, in Korea, but not on those of *Agelastica coerulea*, Baly [*cf. R.A.E.*, A **25** 97]. The females feed more than the males and survive about 10 days without food. The oviposition period lasts 5–9 days, most of the eggs being laid in the first 2 days.

MATSUMOTO (K.) & KIYAMA (R.). **On** *Bruchidius terrenus* **Sharp again.** [*In Japanese.*]—*J. Plant Prot.* **25** no. 2 pp. 109–111. Tokyo, February 1938.

Bruchus (*Bruchidius*) *notatus*, Chujo, which has been misidentified as *B.* (*B.*) *terrenus*, Sharp, has been found in seeds of *Acacia confusa* from Formosa.

Motooka (K.). **On Insect Pests of *Camellia*, L.** [*In Japanese.*]—*J. Plant Prot.* **25** no. 3 pp. 181–185, 1 pl. Tokyo, March 1938.

Of the 18 species of insects known to attack *Camellia* in Japan, the most important is the Noctuid, *Sugitania maculifera*, Mats., all stages of which are described. It has one generation a year. The moths emerge in November and December and oviposit on the leaves and the basal parts of the flower buds. The larvae hatch in late March and early April and feed on the flowers and leaves, sometimes causing serious damage. The fruits of *Camellia* are attacked by the Trypetid, *Euphranta mikado*, Mats., which overwinters as a pupa in the fruit or in the soil.

Oishi (T.). **On *Eriocampoides oishii* Takeuchi, a new Pest of Forest Trees.** [*In Japanese.*]—*J. Plant Prot.* **25** no. 3 pp. 209–211. Tokyo, March 1938.

The larvae of *Caliroa* (*Eriocampoides*) *oishii*, Takeuchi, all stages of which are briefly described, feed on the leaves of oaks, particularly *Quercus serrata*, in Japan. It has at least 2 generations a year, the adults emerging in July–August and in September–October.

Voûte (A. D.). **Bevolkingsproblemen I. De toename van een populatie van *Tribolium* en van de inheemsche bevolking van de Tengger.** [Population Problems. I. The Increase of a Population of *Tribolium* and of the native Population of the Tengger District, Java.]—*Naturk. Tijdschr. Ned.-Ind.* **97** pt. 7 pp. 163–167, 4 graphs, 5 refs. Batavia, 1937.

Voûte (A. D.). **Bevolkingsproblemen II. Emigratie van *Calandra oryzae*, L.** [II. The Migration of *C. oryzae*.]—*T.c.* pt. 8 pp. 210–213, 1 graph, 1 ref. (With Summaries in English.)

Chapman observed that cannibalism prevented a population of the flour beetle, *Tribolium confusum*, Duv. from increasing above a definite concentration [*R.A.E.*, A **16** 312]. The author in Java found that in a saturated population almost every pupa was devoured by the adults and larvae. This cannibalism increased as the moisture of the food decreased, and possibly the need for water is mainly responsible for it.

Observations on the migrations of *Calandra oryzae*, L., which is common in rice in Java, were made to ascertain to what extent stocks of infested rice are a danger to other stocks. It was found that the rate of migration was relatively as well as absolutely higher from a very dense population than from a less dense one. When the denser population was reduced by migration to the level of the other one, the rate of emigration remained higher, and the level on which emigration stopped was lower for the originally dense population.

Glover (P. M.). **Lac Cultivation in India.**—Cr. 4to, [7] 147 pp., 25 pls. Namkum, Ranchi, Indian Lac Res. Inst., 1937. Price *Rs.* 2.

This is a revised and enlarged edition of " A practical Manual of Lac Cultivation " [*R.A.E.*, A **20** 10], since the publication of which conditions affecting the lac industry have changed very considerably. Much that occurs in the original edition is now out of date, particularly

the sections dealing with the plantation growth of lac. The results of the past six years' work at the Indian Lac Research Institute have been incorporated, and the illustrations, with a very few exceptions, are new. Nineteen chapters deal with the bionomics and cultivation of the lac insect (*Laccifer lacca*, Kerr) and production and manufacture of lac, and three are devoted to the insect enemies of the lac insect and their control, enemies other than insects, and insect enemies of lac host-trees ; lists of these trees are also given with their scientific and vernacular names.

SCHIMITSCHEK (E.). **Schlüssel zur Bestimmung der wichtigsten forstlich schädlichen Käfer.** [Key to Identification of the most important Coleoptera injurious in Forestry.]—Med. 8vo, 67 pp., 112 figs., 2 pls. Vienna, J. Springer, 1937. Price *M.* 4·80.

This key to the adults of the most important Coleopterous pests of forests in Central Europe includes figures to facilitate the identification of many of the species. Recognised German popular names are given, and there is an index to scientific and popular names.

SCHWERDTFEGER (F.). **Kulturschädlinge nach Forleulenfrass.** [Pests of Forest Trees restocked after Attack by the Pine Noctuid.]—*Z. Forst- u. Jagdwes.* **68** pp. 653–660, 4 figs. Berlin, December 1936. [Recd. 1938.]

Further observations are recorded on insects attacking young pines in 1935 in a recently restocked area of about 10,000 acres in the Prussian forestry division of Waitze [*cf. R.A.E.*, A **25** 54]. The district is sandy, has a scanty rainfall and a dry, hot spring and autumn. *Hylobius abietis*, L., *Melolontha melolontha*, L., and *M. hippocastani*, F., the chief pests of restocked areas in Germany, were absent, the weevil owing to the lack of fresh stumps for breeding, and the cockchafers owing to the lack of trees for adult feeding. On the other hand, adults of *Brachyderes incanus*, L. [*cf.* **23** 682] fed on pine needles in some places, particularly those with extremely poor soil. *Rhyacionia* (*Evetria*) *buoliana*, Schiff., and *R.* (*E.*) *turionana*, Hb., caused between them the most serious economic injury noted, *R. turionana* being apparently predominant. Over 2,200 acres suffered more or less severely, but in 1935 parasites and diseases had attacked nearly half the larvae. *Thecodiplosis* (*Cecidomyia*) *brachyntera*, Schwäg., was widespread, but it was not numerous and did little harm.

SCHWERDTFEGER (F.) & STAHL (G.). **Untersuchungen über die Bekämpfung des Kiefernspanners mit Kontaktgiften.** [Investigations on the Control of *Bupalus piniarius* with Contact Poisons.]—*Forstarchiv* 1937 pt. 5 repr. 6 pp. Hanover, 1937.

In 1936, 12 proprietary contact dust insecticides were tested against larvae of the pine Geometrid [*Bupalus piniarius*, L.] in Prussia. In the laboratory, batches of 50 larvae were dusted in the Lang-Welte apparatus [*R.A.E.*, A **18** 701] with quantities corresponding to about 45 lb. per acre, fed on untreated material and examined for mortality after two days. Seven insecticides based on derris, pyrethrum or

veratrine caused average mortalities ranging from 44 to 100 per cent., while five based on dinitro-cresol all gave 100 per cent. mortality. The effect of the latter was confirmed in further tests, in which almost complete mortality was obtained in two hours.

In field work between 20th July and 20th August, the insecticides were applied by power dusters at the rate of 45 lb. per acre in unmixed pine stands, each test area covering nearly 2½ acres. The first group of seven insecticides gave average mortalities of 30–79 per cent., while the five dinitro-cresol poisons gave mortalities of from 90 to 99 per cent. The latter caused slight scorching of the pines, but only when the amount applied was excessive.

Dusts containing dinitro-cresol are dangerous to man and animals; protective clothing and a mask must be worn for applying them [*cf.* **25** 525], and their use should be regarded as an emergency measure.

KONSCHAK (M.). **Messung der Entzündungstemperaturen von Aethylenoxyd und T-Gas-Luftgemischen.** [The Determination of the Ignition Temperatures of Mixtures of Ethylene Oxide and T-Gas with Air.]—*Z. hyg. Zool. SchädlBekämpf.* **30** pt. 1 pp. 22–26. Berlin, January 1938.

Experiments were made in Berlin to ascertain the temperatures at which mixtures of either ethylene oxide or T-gas (10 parts ethylene oxide and 1 part carbon dioxide) and air ignite. The technique is described and the results are tabulated. Up to concentrations of 35 volumes of gas per cent. the ignition temperatures for ethylene oxide were a little lower than those for T-gas, but the difference was insignificant at the higher concentrations. Thus, while the temperatures were 555 and 635°C., respectively, for 4 volumes, they were 456 and 455°C. for 35 volumes. With both mixtures the ignition temperatures decreased with increasing dosage, being at their lowest with 20 volumes of ethylene oxide (446°C.) and 20–35 volumes of T-gas (460–455°C.). When the speed at which the gases were introduced into the chamber was raised from 0·5 to 15 cm. per sec., the ignition points were somewhat lower, probably owing to a more rapid mixing. It is concluded that the danger of ignition of mixtures of T-gas and air by heated surfaces is very slight if the official working instructions are followed. These require the removal of heating devices prior to fumigation, and the drenching with water of ashes, etc., in fireplaces and stoves.

VAN DEN BRUEL (W. E.). **Essais pour la lutte contre les mouches de la chicorée de Bruxelles.** (*Napomyza lateralis* **Fall. et** *Ophiomyia pinguis* **Fall.**).—*Bull. Inst. agron. Gembloux* **6** no. 3–4 pp. 218–255, 6 figs., 13 refs. Gembloux 1937. (With Summaries in Dutch, German and English.)

Details are given of experiments in Belgium on the prevention of infestation of forced chicory [*Cichorium intybus*] by *Phytomyza* (*Napomyza*) *lateralis*, Fall., and *Agromyza* (*Ophiomyia*) *pinguis*, Fall. [*cf. R.A.E.*, A **25** 324] by treatment to destroy the larvae in the roots for forcing. Soaking the roots in solutions of nicotine, potassium thiocarbonate or pyridine gave poor results, and fumigation with

nicotine was ineffective. The only method of destroying all the larvae in the roots appeared to be soaking in hot water, and extensive experiments were made with this treatment from 1935 to 1937. The roots were able to withstand soaking at 40°C. [104°F.] for 1½ hours, an exposure that killed practically all the larvae, and were not badly injured if the duration was increased to 2 hours, but the quality of the chicory was slightly affected. They were severely injured and rotted after immersion for 2 hours at 45°C. [113°F.]. The larvae can live in water for 46 days, but are killed or paralysed if submerged for 30 minutes at 40°C. The temperature of the layers of root in which most of the larvae are situated reaches a state of equilibrium with that of the water in 20 minutes. Soaking roots for 1½–2 hours in water at 40°C. seems sufficient to give sound chicory heads, but it would be an advantage to be able to use water of a slightly higher temperature.

FEYTAUD (J.). **La défense des maisons contre les termites.**—*Rev. Zool. agric.* **36** nos. 8 & 10, pp. 113–126, 145–154, 6 figs., 2 refs. Bordeaux, 1937.

This is a general account of the bionomics of termites, the ways in which they infest timber in buildings, and methods of preventing or controlling infestations. There are three species in the south of France, *Calotermes flavicollis*, F., *Reticulitermes flavipes*, Kollar, and *R. lucifugus*, Rossi. The last, which is the most widely distributed, is responsible for considerable injury in buildings. In view of this and the difficulty of eliminating infestation, it is suggested that methods of building will have to be altered so as to prevent it.

VIVIEN (J. H.). **Contribution à l'étude biologique de la mouche de la betterave** (*Pegomyia betae*).—*Bull. biol. Fr. Belg.* **71** no. 3 pp. 322–356, 2 pls., 28 refs. Paris, 1937.

This account of *Pegomyia hyoscyami* var. *betae*, Curt., on beet is based on observations made in five localities in the department of the Somme from 1931 to 1936. Detailed descriptions are given of all stages, including the three larval instars, and of the processes of pairing and oviposition of this Anthomyiid, and its systematic position is discussed. From experiments in which the larvae fed and females oviposited exclusively on Chenopodiaceae, particularly beet and *Chenopodium*, whereas *P. hyoscyami* Panz., and *P. bicolor*, Wied., appeared similarly restricted to Solanaceae and *Rumex*, respectively, the author considers that *betae* should be accorded specific status.

The life-history was in general similar to that recorded in Germany [*R.A.E.*, A **22** 211]. In the summer, the egg, larval and pupal stages lasted 2–4, 11–21 and 18–20 days, respectively, and the preoviposition period 5–8 days. In the laboratory, there were 2–3 overlapping generations a year, and a fourth was reared in 1933. Some pupae of the second generation hibernated, beginning the diapause as early as July. The diapause lasted up to 10 months, and in rare cases 22.

Infestation is spread mainly by wind, as the adults are weak fliers. A larva consumes up to 4 young leaves, and in favourable years, such as 1931 and 1933, infestation of the cotyledons of beet by larvae of the first generation in May sometimes destroys the entire crop. In 1932

and 1933, infestation was checked by parasites. The larvae of the third generation, in August and September, generally occurred on *Chenopodium album*, which is common in the beet-fields.

COUTINHO SARAIVA (A.). **Sôbre uma cochonilha nova de Portugal, *Asterolecanium seabrai*, n. sp.**—*Mem. Mus. zool. Univ. Coimbra* (1) no. 92, 31 pp., 5 pls. Coimbra, 1936. (With a Summary in French.)

COUTINHO SARAIVA (A.). **Coccideas novas de Portugal. 2. *Asterolecanium conimbrigensis*, n. sp.**—*Op. cit.* no. 94, 18 pp., 5 pls. Coimbra, 1936. [Recd. 1938.]

Detailed descriptions are given of the first-instar larvae and adult females of *Asterolecanium seabri*, sp. n., and *A. conimbrigensis*, sp. n., both taken on oaks about 6 miles from Coimbra. *A. seabri* was found exclusively on the bark of *Quercus faginea*. *A. conimbrigensis* was observed on *Q. humilis* and *Q. hybrida* and occurred mainly on the bark, though at the end of spring many young larvae migrate to the leaves.

Neem Leaves as an Insecticide.—*Gold Cst Fmr* **6** no. 10 p. 190. Accra, February 1938.

A small sack containing cacao beans alone, one containing cacao beans mixed with 8 per cent. air dried leaves of neem [*Melia azadirachta*], and a third lined with dry neem leaves and containing cacao beans were each placed in a separate glass jar together with two broken cacao beans and 25 moths, mostly *Ephestia cautella*, Wlk. After nine months 30 per cent. of the beans in the first sack were attacked, and larvae and pupae were found inside the sack and adults outside. No beans in the second sack, and 1 bean out of 100 in the third was infested; no larvae were found inside these sacks, but pupal cases and living larvae and adults were found outside. Apparently the neem leaves repelled either the females, so that they did not oviposit through the sacking, or the young larvae, so that they did not enter the sacks.

It would be undesirable in practice to mix the leaves with the cacao, as this would entail additional winnowing.

HENRARD (P.). **Les insectes parasites du cotonnier dans la région de Lisala.**—*Bull. agric Congo belge* **28** no. 4 pp. 609–624, 7 refs. Brussels, December 1937.

Records are given of the insects observed on cotton in the course of five months in the district of Lisala, in the north of the Belgian Congo, together with notes on the types of damage they cause and the possibilities of controlling some of them by biological or other methods. In addition to grasshoppers, those identified specifically comprise *Aphis gossypii*, Glov., *Bemisia gossypiperda*, Misra & Lamba, *Empoasca facialis*, Jac., *Helopeltis bergrothi*, Reut., *H. sanguineus*, Popp., *Oxycarenus hyalinipennis*, Costa, *Dysdercus superstitiosus*, F., *D. melanoderes*, Karsch., *Anoplocnemis curvipes*, F., *Nezara viridula*, L., the Nitidulid, *Brachypeplus pilosellus*, Murr., the Galerucid, *Copa occidentalis*, Wse., *Syagrus calcaratus*, F., *Heliothis* (*Chloridea*) *armigera*, Hb., *Cosmophila flava*, F., *Prodenia litura*, F., *Platyedra gossypiella*, Saund., *Acrocercops bifasciata*, Wlsm., and *Sylepta derogata*, F.

Michel (M. l'Abbé). **Sur quelques insectes qui vivent aux dépens des " Sycomores " des avenues de Moulins.**—*Rev. sci. Bourbon.* 1937 pp. 24–28, 1 ref. Moulins, 1937.

Brief notes are given on insects reared in the spring, in central France, from sycamores (*Acer pseudoplatanus*) that had been felled in the previous winter because they were dying. The species thought to be injurious comprise *Platypus cylindrus*, F., *Xyleborus xylographus*, Say (*Xyleborinus saxeseni*, Ratz.), *Pyrochroa coccinea*, L., and a Siricid. Larvae of *P. coccinea* were numerous under the bark, in which they ate out large irregular cavities that extended slightly into the sapwood. The abundance and type of frass had previously suggested that the larvae are predacious, but the author considers that they are xylophagous, as no Longicorn larvae were found where they occurred and their size and the course of their galleries both indicated that they were not predacious on *Platypus* or *Xyleborus*. This view was confirmed by subsequent observation of damage caused by them to oak. This Pyrochroid is particularly common on beech at high altitudes. Damage consists in loosening the bark, which renders the wood susceptible to injury by external agents.

Gwynn (A. M.). **Factors affecting the Attacks of Sucking Insects on Cotton.**—*E. Afr. agric. J.* **3** no. 4 pp. 314–318, 2 refs. Nairobi, January 1938.

The author discusses the degree to which infestation of cotton by the various Rhynchota that commonly attack it in Africa may be affected by the condition of growth of the plants. He concludes that it is always desirable to consider whether the attacks of any particular pest can be correlated with some factor influencing plant health, and hence whether the pest can be treated through the plant; but that in general the incidence of pests is determined by the interaction of a large number of more or less independent factors, of which plant health is only one, others being climate, varietal resistance, natural enemies, etc. In field observations it is impossible to disentangle satisfactorily the effect of the health of the plant from other factors. Therefore questions arising out of the effect of climate and plant health on insect abundance cannot be finally settled without detailed experiments under completely controlled conditions. Such experiments are for the present outside the province of the economic entomologist, because the data obtainable from field observations and experiments, though imperfect, are sufficient as a working basis.

Bodkin (G. E.). **Contre le *Phytalus*. Communiqué du directeur de l'agriculture sur la campagne de lutte contre le *Phytalus smithi* Arrow pendant la période 1936–37.**—*Rev. agric. Maurice* no. 96 pp. 210–214. Port Louis, 1937.

This is a summary of recent work on the introduction into Mauritius of parasites and predators for the control of *Lachnosterna* (*Phytalus*) *smithi*, Arr., on sugar-cane [*R.A.E.*, A **24** 666, 785; **25** 788], and includes a brief account of an experiment confirming general experience that hand-collection of the adults does not significantly reduce the population [*cf.* **26** 176]. More than 5,000 larvae of the predatory Elaterid, *Pyrophorus luminosus*, Ill., have been imported

from Porto Rico and distributed, and a new generation has been bred under laboratory conditions. In 1930–31, W. F. Jepson found that white grubs in the west of England were parasitised by *Dexia rustica*, F., and in 1936 the rate of parasitism was 50 per cent. Some of the grubs were therefore sent to Mauritius, and adult flies were obtained from them. P. Regnard has found 4 Dipterous parasites of Lamellicorn adults or larvae and 8 Scoliids in South Africa, and a first consignment of parasitised white grubs has been received in Mauritius in excellent condition. Of previously introduced Scoliids, *Campsomeris phalerata*, Sauss., has become well established in two localities and 2,500 females have been collected for distribution in other parts of the island, while *Campsomeris pilosella*, Sauss., is now so well established that further liberations appear to be superfluous. *Stachytarpheta jamaicensis* and *Eupatorium pallescens* are being widely planted to provide food for the adult Scoliids. In conclusion the author recommends the importation of *Bufo marinus* [*cf.* next abstract].

DE SORNAY (P.). **Le** *Bufo marinus*.—*Rev. agric. Maurice* no. 96 pp. 214–216. Port Louis, 1937.

As a result of correspondence with workers in different parts of the world on the proposed introduction of *Bufo marinus* into Mauritius for the control of *Lachnosterna* (*Phytalus*) [*smithi*, Arr.], the author tabulates data showing that, in general, *B. marinus* has been effective against insect pests only when introduced into countries where frogs and toads either did not already exist or were quite uncommon. He points out that in Porto Rico it has been found feeding on *Pyrophorus luminosus*, Ill. [*R.A.E.*, A **25** 441], a predacious Elaterid that has recently recently been introduced into Mauritius [see preceding abstract]; that another toad, *Bufo insularis*, is widely distributed in Mauritius and eats *L. smithi* but has not controlled it; that in Formosa *B. marinus* feeds on the indigenous toad, *Bufo melonosticus* [**24** 698]; and that although one man can collect 2,000 beetles in one evening in Mauritius, probably 200 toads would be needed to dispose of the same number [*cf.* **22** 621], and extensive hand collections have already been proved to be ineffective in reducing the population. For these reasons, he considers the value of the proposed introduction into Mauritius to be highly problematical.

JEPSON (W. F.). **Projet des travaux de recherche se rapportant au contrôle biologique des borers de la canne à sucre à Maurice.**—*Rev. agric. Maurice* no. 96 pp. 217–223. Port Louis, 1937.

The damage caused to sugar-cane in Mauritius by moth borers, of which the most important is *Diatraea venosata*, Wlk., is discussed, and a list is given of their parasites [*cf. R.A.E.*, A **22** 259]. Records of the percentages of internodes infested by moth borers in Mauritius [**26** 176] and in other countries (chiefly the West Indies) are compared in a table, and another shows the amount of injury to 5 different varieties of sugar-cane in Mauritius. The importation of parasites for biological control of *D. venosata* is recommended, the surveys that would be necessary for this purpose are outlined, and the expenses involved are estimated.

Andrewartha (H. V.). **A new Species of Thysanoptera of economic Importance in South Australia.**—*Trans. roy. Soc. S. Aust.* **61** pp. 163–165, 1 fig., 5 refs. Adelaide, 24th December 1937.

Both sexes of *Frankliniella lycopersici*, sp. n., are described from roses in Victoria, and from roses, carnations and tomatos in South Australia. It is the vector of spotted wilt of tomatos in South Australia previously recorded as *F. insularis*, Frankl. [*cf. R.A.E.*, A **18** 666; **19** 28; **20** 212; **23** 507, etc.].

Fowler (R.). **The Removal of Spray Residue from Apples.**—*J. Dep. Agric. S. Aust.* **41** no. 5 pp. 457–461. Adelaide, December 1937.

In view of the fact that shallow immersion reduces the percentage of core rot caused in apples with open calyx tubes by the entry of acid during washing [*R.A.E.*, A **25** 93], tests were made to compare the effects of washing such apples in a flotation machine with those of washing by the immersion method. The flotation machine is briefly described. The apples tested had received 5 sprays of lead arsenate, with or without oil; they were picked 34 days after the last spray and washed 4 days later. The washing solutions were 1 and 3 per cent. hydrochloric acid, followed by immersion in lime water [*cf. loc. cit.*], and 8 per cent. sodium silicate. The apples remained in the solutions for approximately 1 minute; after treatment they were throughly rinsed in fresh water and dried. All the washing solutions were effective in reducing arsenical residues, which were not large, but the sodium silicate gave less consistent results than the acid. Core rot due to the penetration of the acid solutions develops fairly rapidly, and apples so affected show evidence of it within a short time of storing. Of the apples treated with the weaker and stronger acid solutions in the flotation washer, 1 and 2·5 per cent., respectively, developed core rot during a storage period of 10 weeks. The percentages were 1·22 and 4·45 for apples washed by shallow immersion, 5·4 for those deeply immersed in the weaker solution, and 2·66 for apples treated by shallow dipping in the weaker solution but not rinsed in lime water.

It is concluded that in washing apples with open calyx tubes by dipping, the depth of immersion must be carefully controlled; they cannot with safety be dipped deeply in 1 per cent. HCl or shallowly in 3 per cent. HCl.

Krukoff (B. A.) & Smith (A. C.). **Rotenone-yielding Plants of South America.**—*Amer. J. Bot.* **24** no. 9 pp. 573–587, 5 figs., 7 refs. Lancaster, Pa, November 1937.

Panshin (A. J.). **Wood Anatomy of certain South American Rotenone-yielding Plants.**—*T.c.* pp. 587–591, 10 figs.

The first paper comprises an account of the rotenone-yielding plants of South America [*cf. R.A.E.*, A **25** 760] and includes descriptions of *Derris amazonica* and nine species of *Lonchocarpus*, of which three are new and two unnamed. Notes are given on their geographical distribution, habitat, rotenone content and commercial importance, and the popular names are indicated for each species. Identification is rendered difficult because the plants are seldom found in a flowering state and there is considerable variation between the upper and lower leaves.

The most important species commercially in Peru is *L. utilis*, sp. n. (known as barbasco or cubé), which also occurs in Brazil and Ecuador. Since 1930, it has been misidentified as *L. nicou* [*cf.* **18** 376, etc.], which, however, appears to be limited to Dutch Guiana and is very poor in rotenone. Roots of *L. utilis* yielded 12 per cent. rotenone and 25 per cent. total ether extractives. The principal species in Brazil is *L. urucu*, which is widespread and extends to Peru and Colombia. Its percentage yields of rotenone and total extractives were 4·4 and 17. An unnamed Brazilian species contained 7 per cent. rotenone, but its roots are seldom collected. *L. martynii*, sp. n. (white haiari), *L. chrysophyllus* (black haiari) and *Lonchocarpus* sp. (red haiari) occur in British Guiana, the last two also in Dutch Guiana, and had rotenone contents of 2·3, 2·1 and about 2 per cent., respectively. *L. martynii*, which yielded 10·1 per cent. total extractives, is being experimentally cultivated in British Guiana and Malaya. The other species mentioned were poor or entirely lacking in rotenone. A note is added on an unidentified leguminous plant that was observed in several localities in Brazil. It contained a small amount of rotenone, though it does not belong to any of the genera of South American plants from which rotenone has previously been recorded.

Field observations showed that plants of *Lonchocarpus* that had abundant thick white latex in the roots were rich in rotenone, a high percentage of which was contained in the latex.

The second paper includes the results of laboratory investigations on the structure of the root and stem xylem of the species mentioned in the first, and descriptions of the wood, together with illustrations. It is concluded that there exists a great similarity in the structure of the xylem in all species, but that the differences in colour of the root wood are sufficiently constant for purposes of identification.

DA COSTA LIMA (A.). **Outras moscas cujas larvas são predadores de Coccideos.** [Other Flies with Larvae that attack Coccids.]—*Chacaras e Quint.* 1937 repr. 4 pp., 6 figs. S. Paulo, 15th February 1937. [Recd. 1938.]

Descriptions are given of two additional Diptera the larvae of which attack Coccids in Brazil [*cf. R.A.E.*, A **24** 92]. One is a Drosophilid, *Pseudiastata brasiliensis*, sp. n., attacking *Pseudococcus brevipes*, Ckll., on *Eriochloa punctata*, and the other is an unnamed Anthomyzid attacking *Orthezia praelonga*, Douglas.

FONSECA (J. P.). **A broca verdadeira e a falsa broca do café.** [The true and false Coffee Berry Borers.]—*Biologico* **3** no. 12 pp. 366–368, 2 figs. S. Paulo, December 1937.

Coffee growers in Brazil have sometimes mistaken *Stephanoderes seriatus*, Eichh., for *S. hampei*, Ferr. [*R.A.E.*, A **14** 361]. *S. seriatus* does not infest the coffee bean [*cf.* **13** 388], but females penetrate the pulp of the fruits, on which they feed, and oviposit. The larvae develop and pupate in the pulp. The species is polyphagous, and has been recorded in a variety of dry and withered fruits. Morphological differences between the adults of these two Scolytids are indicated.

Fonseca (J. P.) & Amaral (J. F.). **A traça da batatinha e sua occorrencia no Brasil.** [*Phthorimaea operculella*, Zell., and its Occurrence in Brazil.]—*Biologico* **3** no. 12 pp. 369–377, 5 figs. S. Paulo, December 1937.

In view of the recent record of *Phthorimaea operculella*, Zell., from potato in São Paulo [*R.A.E.*, A **26** 145], instances are given from the literature of its being observed on tobacco and other Solanaceae in Brazil since 1924 [**13** 21 ; **14** 17 ; **16** 635] and of its importation in potato from Europe [*cf.* **11** 442]. Brief descriptions are given of all stages of this Tineid and of the damage it causes to potato tubers. Methods of control are suggested.

Rusk (H. W.). **Relationship of Grains of Spray Residue per Pound of Apple to Micrograms per square Centimeter of Surface. A Conversion Table.**—*Hoosier Hort.* **19** no. 7 pp. 109–112, 3 refs. Lafayette, Ind., July 1937. [Recd. 1938.]

As work on the control of the codling moth [*Cydia pomonella*, L.] in the United States has shown that the effectiveness of a spray deposit depends largely on its concentration on the surface of the apple [*cf.* *R.A.E.*, A **22** 217], a table is given for converting spray deposit from grains per lb. to micrograms per sq. cm., when the number of apples per lb. is known. The errors inherent in the use of the formula for calculation [*cf.* **21** 468] are briefly discussed, and it is considered that, altogether, they will not affect the results by more than 5 per cent.

Fahey (J. E.) & Rusk (H. W.). **Chemical Studies of Spray Deposits.**—*Trans. Ind. hort. Soc.* **76** (1936) pp. 85–90. Indianapolis, 1937.

The results are given of determinations of deposits of lead on apples treated with various sprays containing lead arsenate for the control of the codling moth [*Cydia pomonella*, L.] in Indiana. The deposits for apples on the trees are given in micrograms per sq. cm. in growth experiments, and per fruit in weathering experiments [*cf.* preceding abstract], and those on harvested fruit in grains per lb.

The conclusions drawn are summarised as follows : Fruit growth is so rapid early in the season that residues per unit area may be decreased as much as 20 per cent. per day, but between the final cover spray and harvest the decrease is less than 1 per cent. per day. Weathering removes from 40 to 60 per cent. of all spray deposited, depending upon the type of residue. Factors of weathering other than rainfall are largely responsible for reduction of residue loads. Adhesives used with or following lead arsenate sprays complicate spray-residue removal. Second-brood sprays are responsible for most of the residues at harvest. These residues are relatively easy to remove, however, provided that no adhesive is used in the spray mixture.

Cupples (H. L.). **Wetting and Spreading Properties of Aqueous Solutions. Mixtures of Sodium Hydroxide with n-Caproic, n-Caprylic, n-Capric, Lauric, Myristic, and Palmitic Acids.**—*Industr. Engng Chem.* **29** no. 8 pp. 924–926, 1 fig., 7 refs. Easton, Pa, August 1937. [Recd. 1938.]

This paper extends previous work [*R.A.E.*, A **24** 213, 777 ; **25** 234] to mixtures of sodium hydroxide with the six additional fatty

acids given in the title, at the concentration of 1 gm. fatty acid per 100 cc. Some of the previously reported measurements with oleic acid mixtures are included for comparative purposes.

The insecticidal efficiency of a contact spray is directly related to its wetting power, but the object of application of stomach poisons and protective fungicides is to produce a maximum deposit distributed evenly over the surfaces to be protected. Solutions with high wetting power will generally produce excessive run-off, causing a loss of spray material and a lessened deposit of the active material. Maximum efficiency in a spray solution of this type may well be associated with a low spreading coefficient (wetting power) [*cf.* **24** 213], but if it is too low, the spray solution may collect in drops. The spreading coefficient is obtained by subtracting the sum of the interfacial tension of the mixture with a reference mineral oil and the surface tension of the mixture from the surface tension of the reference oil, which is a constant value at a given temperature. The surface tension and the interfacial tension against oil of the mixtures containing sodium hydroxide and a fatty acid in different molar proportions are measured by a procedure similar to that employed in previous work [**24** 213], and the results are given in tables. The surface tension decreases with increase in weight of the fatty acid. The curves produced by plotting surface tension against moles sodium hydroxide per mole fatty acid are all similar in form, showing a minimum surface tension below a mole ratio of 1·0, a sharp rise at a ratio of 1·0 and a gradual decrease beyond this point. The curves representing the variation of interfacial tensions of the same solutions against mineral oil with the composition of the mixtures are similar to the surface tension curves. Minimum interfacial tensions are obtained with a ratio of alkali to fatty acid less than 1·0. At about the ratio 1·0 a sharp rise occurs, and above this point there is a gradual decrease. In their effectiveness in lowering the interfacial tension, the fatty acids follow the same order as their molecular weights, and this relation is more nearly uniform than in the case of surface tension. The spreading coefficient shows relationships that are similar, but inverse, to the other two sets of curves, as would be expected. The magnitudes of the spreading coefficients, at least in the range of ratios of alkali to fatty acid above 1·0, are in the same order as the corresponding molecular weights.

Goodhue (L. D.) & Siegler (E. H.). **A motor-driven telescoping Stirrer for Use with an Insecticide Spraying Apparatus.**—*Leafl. U.S. Dep. Agric. Bur. Ent.* no. *ET* 114, 2 pp., 1 fig. Washington, D.C., December 1937.

A description is given of a motor-driven stirrer for use with a laboratory spraying apparatus already noticed [*R.A.E.*, A **23** 649].

Cotton (R. T.), Wagner (G. B.) & Young (H. D.). **The Problem of Controlling Insects in Flour Warehouses.**—*Amer. Miller* **65** no. 11 pp. 22, 24, 26, 79; 2 figs. Chicago, Ill., November 1937.

Sections of this paper deal with the distribution of *Tribolium confusum*, Duv., in individual bags of flour, the effect of temperature on insect development in stored flour, and general warehouse fumigations. *T. confusum* was generally found in the central part of the flour only in bags that were heavily infested, and its presence there was

probably due to temporary wandering, as dead adults and larvae were absent. One bag that had been stored for 5 months contained 12,419 examples of this beetle. In parts of the United States subject to cold winters, the temperature is sometimes sufficiently low to destroy the insects infesting the warehouses. Experiments showed that all stages of *Ephestia kuehniella*, Zell., *T. confusum*, *T. castaneum*, Hbst., *Plodia interpunctella*, Hb., and *Oryzaephilus surinamensis*, L., died in a day at 0·5°F. The periods in days required for complete mortality at 10–15, 15–20, 20–25 and 25–30°F., were, respectively, 4, 7, 24 and 116 for *E. kuehniella*, 1, 1, 5 and 12 for *T. confusum*, 1, 1, 5 and 8 for *T. castaneum*, 5, 8, 28 and 90 for *P. interpunctella*, and 3, 3, 7 and 23 for *O. surinamensis*.

Flour warehouses are usually fumigated at the same time as the flour mills with which they are connected, either with the same or with an increased concentration of the fumigant. Unless, however, very large dosages are used in the warehouses, fumigation is unsuccessful, as the greater part of the gas is absorbed by the flour on the outside of the stacks, and that inside is exposed only to very low concentrations. Data are given on the fumigation with hydrocyanic acid gas of 5 flour warehouses of different types of construction. Whereas, in all cases, the mortality of flour beetles was greater than 80 per cent. where the gas had free access, insects that were placed inside or between bags were protected from the gas and only a few were killed. Mortality was not materially increased by leaving samples of insects in the fumigated flour for an additional 24 or 48 hours. Experiments in air-tight fumigation vaults indicate that a dosage of approximately 12 oz. liquid HCN per ton of flour is necessary to give 100 per cent. mortality of flour beetles buried in the middle of 140 lb. bags of flour when the temperature of the flour is above 70°F. It cannot be expected that thorough penetration will be obtained under warehouse conditions with lower dosages. In one warehouse fumigated at 78°F. with 9 oz. HCN. per 1,000 cu. ft., the concentration in the open space dropped from 4·6 to 1·6 oz. in about 90 minutes, while between two 98 lb. bags of flour it did not reach 0·5 oz.

The proper type of redressing machinery should be used to ensure that only insect-free flour is placed in storage ; sifters, clothed with 10 XX and 11 XX cloth, placed directly over the packer bins will prevent insects from being packed with the flour. The use of reels for redressing does not prevent insects from passing on to the packer bins. Stocks for blending, returned infested flour, or used bags should never be stored in or near the flour warehouse. Screenings and overs from redressing machinery should be spouted directly to a fumigating vault or sterilising chamber. Freshly milled flour should not be stored temporarily near bran or other material likely to harbour insects.

Piemeisel (R. L.) & Lawson (F. R.). **Types of Vegetation in the San Joaquin Valley of California and their Relation to the Beet Leafhopper.**—*Tech. Bull. U.S. Dep. Agric.* no. 557, 28 pp., 14 figs., 12 refs. Washington, D.C., June 1937. [Recd. April 1938.]

In view of the finding that the prevalence of weeds that serve as food-plants of *Eutettix tenellus*, Bak., in southern Idaho is due to overgrazing or the abandonment of ploughed land [*R.A.E.*, A **25** 715], an investigation was made of the extent and composition of the present vegetation and the original types in the San Joaquin Valley,

where the situation is quite similar. The types of original vegetation were reconstructed from the studies made and their probable boundaries were mapped, as also were the boundaries of the present vegetation. Each of the principal original types shown on accompanying maps is briefly described. The derivation of present stands from the original, through modification or destruction, is discussed, as well as the relation of the present stands of each particular type to *E. tenellus*. These interrelationships for the valley as a whole are indicated diagrammatically, and the more important ones are discussed.

It is concluded that in California *E. tenellus* utilises two groups of plants for breeding. One group, the summer food-plants, chiefly Russian thistle (*Salsola pestifer*), bract scale (*Atriplex bracteosa*), and fogweed (*A. expansa*), is found to the greatest extent on intermittently farmed lands, while the other group, the winter food-plants, such as plantain (*Plantago erecta*), peppergrass (*Lepidium nitidum*) and some species of minor importance, is found where grazing is heaviest and the plant cover is thin or the soil nearly bare. A contemplated reduction of food-plants need operate on only one of these groups, although it is extremely probable that if the acreage of both were reduced the reduction of either need not be so complete. The correction of the two uneconomic practices, intermittent farming and destructive grazing, is in accordance with the general principles of land conservation.

Strong (L. A.). **Report of the Chief of the Bureau of Entomology and Plant Quarantine, 1937.**—98 pp. Washington, D. C., U.S. Dep. Agric., 1937.

A concise account is given of work on insect pests and their control in the United States during the year ending June 1937, some of which has already been noticed.

Colonies of *Phanerotoma tibialis*, Hald., and *Aenoplex carpocapsae*, Cushm., were forwarded to Idaho and *Ephialtes extensor*, Tschb., was liberated there and in New Jersey, for the control of the codling moth [*Cydia pomonella*, L.]. Of water-soluble compounds tested against the peach borer [*Aegeria exitiosa*, Say], dichlorethyl ether gave good control when applied in February and March, but at higher temperatures in both spring and autumn results were variable and there was a certain amount of injury. This material also gave promise as a soil fumigant against the plum curculio [*Conotrachelus nenuphar*, Hbst.]. Several forms of nicotine-bentonite were effective against the grape berry moth [*Polychrosis viteana*, Clem.], but they caused staining, which was particularly serious in the case of the tank-mixed spray. In the spring, burning over the areas round vineyards where grape leafhoppers [*Erythroneura comes*, Say] were overwintering, considerably reduced the population; in one vineyard in northern Ohio infestation after such treatment was the lightest for many years, whereas in untreated ones in the same locality it was abnormally severe. In cage experiments thiodiphenylamine (phenothiazine) gave almost complete control of the grape rootworm [*Fidia viticida*, Walsh] and appeared to be more effective than arsenicals; nicotine-bentonite was not very toxic to the adults. Oil sprays have an important residual effect on the obscure scale [*Chrysomphalus obscurus*, Comst.], which is not evident until the females are mature; only 1·3–9·5 per cent. of the apparently mature females were able to oviposit on pecan trees in northern Louisiana that were sprayed with 2–3 per cent.

lubricating oil emulsions in February and March, whereas 66–86 per cent. oviposited normally on unsprayed trees. A spray of 3 lb. lead arsenate and 3 lb. lime in 100 U.S. gals. water effectively protected young pecan trees from injury by *Lachnosterna* (*Phyllophaga*) spp. in Louisiana; 4–5 applications were made at frequent intervals, but it is thought that equally good results could be obtained with 3 applications during the earlier part of the period when the beetles are feeding. The motor-driven raisin cleaner [*R.A.E.*, A **25** 409] has been further improved and rendered more efficient in reducing infestation by the raisin moth [*Ephestia figulilella*, Gregson] in California. The first generation of this Pyralid feeds mainly on mulberries [*cf.* **26** 118, etc.], but in one locality Mission figs were of considerable importance in building up the population in the early part of the season. Serious damage by the larvae to fresh grapes on the vines was recorded for the first time. Strains of red scale [*Aonidiella aurantii*, Mask.] on *Citrus*, obtained from different areas, have now been kept in isolation for a year without alteration in the initial differences in their susceptibility to hydrocyanic acid gas [*cf.* **22** 99, etc.]. A single female produced a maximum of 300 young, and in one instance the reproductive period lasted 287 days.

In testing the value of lead arsenate against larvae of the Japanese beetle [*Popillia japonica*, Newm.], it was found that the phosphates of sodium, potassium or ammonium significantly increased its solubility in the soil, and that the first two also increased its toxicity when it was used at the rate of less than 1,000 lb. per acre [*cf.* **24** 292]. Phosphates of calcium increased neither solubility nor toxicity. The addition of up to 10,000 lb. per acre of green-sand marl, which is promising for use in soils to overcome or reduce arsenical injury to plants, did not significantly modify the insecticidal action of lead arsenate within 30 days of application [*cf.* **25** 409]. Fumigation with methyl bromide gave 100 per cent. mortality of larvae infesting strawberry plants packed, with soil on their roots, in crates, and did not affect the plants. Large numbers of females of the imported Scoliid parasite, *Tiphia vernalis*, Rohw., have been collected from established colonies and liberated elsewhere; in the early summer of 1937, 162 colonies, comprising 16,553 females, were released in the north-eastern states. Where colonies of this Scoliid were established in 1933, the parasitism of *P. japonica* has, in some cases, been as high as 58 per cent. *T. popilliavora*, Rohw., has become well established in many places and, in 1936, 4,818 females were collected in the field and re-distributed. A number of the adults did not emerge until 2–3 years after the formation of the cocoon. As the first strain that was introduced was not well synchronised with its host in New Jersey, a Korean strain that emerges later under more favourable conditions for parasitism has been introduced, and 9 colonies were liberated in 1936 in New Jersey and Pennsylvania. In further studies of diseases attacking larvae of *P. japonica* [**24** 142, 292] and the Asiatic garden beetle [*Aserica castanea*, Arr.], field observations showed that the percentage infection was low in the early spring and increased to a maximum of 36 in late June. It fell rapidly as the new brood of larvae developed and increased to 13 in September. In field plots where A and B types of milky disease were artificially introduced in the spring of 1935, infection rose to 44 per cent. in June 1936, but less satisfactory results were obtained with inoculation of similar plots in the autumn, probably on account of unfavourable weather conditions. Liberations

of 1,400 females of *Tiphia sternata*, Parker, a parasite of *A. castanea*, were made in 5 centres in New Jersey and Pennsylvania, and a few recoveries were made of this species and of *Tiphia asericae*, Allen & Jaynes, in the spring of 1937.

In experiments in Mexico, exposure of infested fruit to a temperature of 34–35°F. for 16 days did not prevent subsequent emergence of adults of the Mexican fruit-fly [*Anastrepha ludens*, Lw.]; puparia were formed by larvae exposed for 17–18 days, but no adults emerged from them. Of young flies exposed for 6 days to cold weather with a minimum temperature of 26·9°F., 70 per cent. survived and then infested fruit normally [*cf.* **24** 292]. Bait-sprays of 4 lb. tartar emetic and 20 lb. granulated sugar in 100 U.S. gals. water gave up to 90 per cent. control, and fruit remained on sprayed grapefruit trees until June, whereas it fell from unsprayed trees early in the season. Prolonged experiments in Florida have shown that *Citrus* is not affected by repeated applications of mist sprays of 4 lb. tartar emetic and 5 U.S. gals. molasses in 100 U.S. gals. water. In Texas, the progress of infestation in the Rio Grande valley suggested that it was initiated by flies that had migrated from Mexico during the winter months, the movement apparently terminating in mid-March. In experiments carried out in Hawaii, larvae of the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] did not give rise to adults when infested fruit was kept at 33°F. for 10 days or at 36·5°F. for 12 days; there was 100 per cent. mortality of the early stages when infested fruit was kept in sealed containers, but the effect of such treatment on sound fruit has not yet been determined. In the case of the melon fly [*Dacus cucurbitae*, Coq.], exposure of infested fruit to 36·5°F. for 10 days was sufficient. Both ripe and commercially picked papayas were susceptible to attack by *D. cucurbitae*; infestation of cucumbers was reduced by screens that prevented the flies from drifting on to the plots, but nicotine sprays gave more promising results from the standpoint of cost. In Porto Rico, larvae of *Anastrepha suspensa*, Lw., and *A. acidusa*, Wlk., in fruit, were unable to complete their development after exposures of 11 and 13 days to 32 and 34°F., respectively; after 15 days at 36°F. they were able to form puparia, but no adults were obtained after 12 days' exposure. In sterilisation studies with the vapour heat process, there were a few survivals after exposing infested fruit to temperatures that rose to 110°F. in the course of 8 hours, and were maintained at that level for an additional 8 hours.

In further work on Dutch elm disease, it has now been established that *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., is a vector of *Ceratostomella ulmi*, as well as *Scolytus multistriatus*, Marsh. Adults of *H. rufipes* that emerge in the autumn bore into the bark of living elm trees, sometimes as far as the xylem, and overwinter there; if they are infected with the fungus, the disease may develop and cause the death of the tree. In certain areas in Ohio and Indiana, diseased trees occur although *S. multistriatus* appears to be absent, and *H. rufipes* is probably the vector there. In collections of insects from felled elms in seriously affected areas in New Jersey, the fungus was cultured from *Magdalis armicollis*, Say, *Xyleborus* (*Xylosandrus*) *germanus*, Bldf., *Xylobiops basilare*, Say, and *Conotrachelus anaglypticus*, Say, but the percentage contamination was significant only in *S. multistriatus* and *H. rufipes*.

Both in the west and in several localities in the east, a blighted condition of the twigs of several species of pines was associated with infestation by different species of *Matsucoccus*.

Notes are given on the infestation of maize in different areas by the European corn borer [*Pyrausta nubilalis*, Hb.], on the liberation of parasites against it, and on the breeding of strains that are resistant to it and to the corn earworm [*Heliothis armigera*, Hb.]. The Hessian fly [*Mayetiola destructor*, Say] infesting wheat was much reduced in numbers owing to unfavourable weather conditions. Strains of the fly from California and Indiana showed a marked difference in their ability to infest the same varieties of wheat under similar conditions of soil and climate. In some resistant varieties of wheat, most of the first-instar larvae are unable to moult, and the few that develop are usually distorted by pressure of the leaf sheaths. The larvae also develop on numerous species of wild grasses, and strains of these vary greatly in resistance, which appears to be correlated with the character of the tissues of the leaf sheaths. Species with soft, yielding stems are usually the most heavily infested. Adults of the alfalfa weevil [*Hypera variabilis*, Hbst.] were found to survive in small numbers in baled lucerne hay throughout the winter. In the Grand Valley of western Colorado, where infestations have only recently developed, the first crop was damaged before it was ready for cutting [*cf.* **25** 411]. There, the weevils mature in the year that they become adult and the females oviposit in the autumn and again as soon as the first warm days occur in spring, whereas in Utah oviposition only begins gradually as spring advances. *Saccharosydne saccharivora*, Westw., which had not previously been recorded in the United States, caused severe injury to some varieties of sugar-cane in Florida.

The introduction of steam into vacuum tanks used for fumigation against insects infesting cereal products raised the temperature uniformly throughout the tank and its contents when the pressure registered 0·15 inch. A temperature of 122°F. maintained for 3 minutes under these conditions killed several species of insects, including the resistant eggs of the confused flour beetle [*Tribolium confusum*, Duv.], all buried in wheat in a tank. Previous work had suggested that heavy gases, such as chloropicrin and a mixture of carbon bisulphide and carbon tetrachloride, applied to the surface of grain in storage bins would effectively penetrate to the bottom of the bin ; in experiments, however, in which containers of insects were buried at each 15-ft. level of a 60-ft. bin, these gases did not penetrate to a depth of 30 feet. The relative toxicity of various fumigants to eggs and adults of *T. confusum* and the flour moth [*Ephestia kuehniella*, Zell.] were tested with exposures of 1, 3 and 24 hours. With all exposures, ethylene oxide and hydrocyanic acid gas were more toxic to the eggs than to the adults of *T. confusum* ; and the adults of both species were more susceptible than the eggs to chloropicrin, carbon dichloride, and ethylene dichloride. With exposures of 1, 3 and 24 hours to ethylene oxide, the eggs of *Ephestia* were, respectively, as susceptible as, slightly more resistant, and more susceptible than the adults ; HCN, at all exposures, was more toxic to the adults than to the eggs.

Infestation by grasshoppers was very widespread in 1937 ; it was found possible to increase the percentage of sawdust in poison baits from 50 to 75 by using bran containing shorts and middlings.

In comparative tests on the control of *Pheletes* (*Limonius*) *californicus*, Mann., and *P.* (*L.*) *canus*, Lec., attacking onions in Washington, by

fumigants mixed with the soil when it was being ploughed, crude naphthalene (800 lb. per acre) gave 92 per cent. mortality and cost less than calcium cyanide (400 lb. per acre) which gave 78 per cent. Sulphur applied to the soil surface at rates of 400 and 800 lb. per acre did not prevent oviposition by either species. In the irrigated section of the Pacific Northwest in 1936, the percentages of injury to potatoes planted on 7th April and 23rd June and harvested in mid-August and early November, respectively, were 57 and 44, the difference being less than in previous years owing to conditions that delayed the seasonal downward migration of the wireworms. In Alabama, the Gulf wireworm [*Heteroderes laurenti*, Guér.] was less abundant in fields undergoing suitable crop rotation and in cotton fields than in those where potatoes were planted every year. Trapping the adults under crop remnants raked into windrows, which were then burnt, was effective only when the soil was thoroughly cleaned of plant débris and the surface levelled. Soil fumigation with crude naphthalene was not effective against this species or the sand wireworm [*Horistonotus uhleri*, Horn] in South Carolina.

In Ohio and Virginia, field experiments against the Mexican bean beetle [*Epilachna varivestris*, Muls.] on beans grown for the green-bean market or for canning have shown that the best control, at a minimum cost, can be obtained with sprays or dusts of cubé or derris. Cryolite dusts and sprays gave variable results, but a spray of cryolite was effective in Colorado on irrigated beans grown for the dry-bean market. It was significantly better than a spray of zinc arsenite and was cheaper than sprays and dusts containing rotenone, which were also effective. In field tests against the pea Bruchid [*Bruchus pisorum*, L.] in Oregon, a dust containing 0·75 per cent. rotenone with talc as diluent appeared to be more effective than others containing 0·25, 0·50, and 0·75 per cent. rotenone with diatomaceous earth. Two applications of all the dusts were given, and the control averaged 97·7 per cent. In Washington, under favourable weather conditions, 95–99 per cent. control on canning peas was obtained by 1–3 applications of dusts containing rotenone, particular care being taken to treat strips 25–30 feet wide bordering the fields, where the hibernating Bruchids had congregated. Deep ploughing of shattered peas on the soil surface with a mould-board plough with proper covering attachments prevented many of the Bruchids in the peas from reaching the surface. A derris or cubé dust mixture containing a specially prepared spreading agent was particularly effective against the pea Aphid [*Macrosiphum onobrychis*, Boy.]. The dust was made by atomising a sodium oleyl alcohol sulphate into it while it was being revolved in a mixer. In eastern Virginia, cryolite, either as a dust (undiluted or mixed with 40 per cent. talc or sulphur) or as a spray (3 lb. in 50 U.S. gals.), gave the best control of *H. armigera* on lima beans and increased the total number of pods. Thiodiphenylamine gave good control, but did not increase the number of pods. Negative results were obtained with various dust mixtures of derris, cubé, pyrethrum, nicotine and sulphur. In analyses of unshelled beans, the fluorine residue was often above the established tolerance of 0·01 grain per lb., but was negligible on shelled beans or those that had been put through the ordinary washing process for canning.

Infestation of tomatos by the pinworm [*Phthorimaea lycopersicella*, Busck] in southern California was considerably reduced by cuprous cyanide, either as a dust with talc (1 : 5) or as a spray (3 lb. in 100

U.S. gals.), or by a dust of natural cryolite with talc or diatomaceous earth. There was a high percentage survival in the winter of 1936–37, although the longest cold spell on record occurred in January, with a minimum of 22°F., and a total of 17 nights when the temperature fell below freezing point [*cf.* **24** 292]. Under favourable conditions in California, the eradication of nightshade [*Solanum* sp.], on which the pepper weevil [*Anthonomus eugenii*, Cano] overwinters, considerably reduced infestation of peppers [*Capsicum*]. Thiodiphenylamine, dibenzothiaphene and commercial preparations containing pyrethrum were less effective against this weevil than calcium arsenate [**26** 64], and the most recently developed washers removed excess arsenical residues from the peppers.

Late applications of dusts and sprays containing 0·5 and 0·01 per cent. rotenone, respectively, against the raspberry fruitworm [*Byturus unicolor*, Say] did not leave harmful residues on the berries and were preferable to thiodiphenylamine, which gave better control but caused severe injury to the foliage, resulting in a decreased yield, and to arsenical sprays and dusts, which, if applied after the blossoms have opened, may leave a residue above the tolerance [*cf.* **25** 412]. Dusting with pyrethrum gave about 97·5 per cent. control of the adults of the tobacco moth [*Ephestia elutella*, Hb.] in tobacco warehouses of the closed type in Virginia. Azalea flower spot disease first appeared in the spring in South Carolina on flowers near the ground, suggesting that the causal organism may remain in the soil or mulch between flowering seasons. With the increase in the numbers of insects, particularly *Bombus* spp., visiting the azalea flowers, the disease spread locally on all parts of the plants. Insects were able to carry the infection 1–5 miles. There was a high mortality of red spider [*Tetranychus telarius*, L.] on strawberry when the infested plants were dipped in an organic thiocyanate spray mixture or in a water suspension of derris.

Free nicotine (40 per cent.) in water, 1 : 100 and 1 : 200, applied 5–6 times at 4-day intervals as a drench (100 cc. per sq. ft.) to mushroom beds, gave a promising degree of control of *Sciara* spp. and other pests, and the beds yielded approximately one-third more mushrooms than those treated at 8-day intervals, and twice as many as the controls. The highest nicotine content of any sample of the treated mushrooms was 29 parts per million, by weight, which is believed to be harmless to the consumer. Fumigation with paradichlorobenzene (1 lb. per 1,000 cu. ft. air space) for 48 hours gave good control of woodlice, but was ineffective against mites and Collembola.

In connection with work on the cotton boll weevil [*Anthonomus grandis*, Boh.], a survey is given of observations in various states on the effect of calcium arsenate on the soil [*cf.* **25** 413]. Continued applications on the Delta soil of Louisiana and Mississippi have not affected cotton production in any way, but excessive quantities were injurious to soy beans and cowpeas; in South Carolina, injury was most noticeable in light sandy soils of low fertility where abnormally large amounts had been applied; in Mississippi, the effect on different crops varied considerably with the soil types. The eggs of the cotton fleahopper [*Psallus seriatus*, Reut.] are parasitised by *Erythelmus* sp. in 6 of the southern States, and by *Anaphes anomocerus*, Gir., in Arizona and Texas; it is thought that *Erythelmus*, which is the more important, overwinters in the eggs and that it also parasitises those of other Capsids. Field tests in Texas with quick-maturing varieties of cotton showed that damage by the pink bollworm [*Platyedra gossypiella*,

Saund.] in heavily infested areas can be reduced considerably by selection, and by close spacing and controlled irrigation, which result in early maturity and reduction of late-season damage and of the autumn population that hibernates. Although large quantities of arsenicals were used to control the cotton leaf-worm [*Alabama argillacea*, Hb.] in 1936, it caused serious injury where it appeared early in the season. Defoliation of the mature plants resulted in a great reduction of the overwintering population of *Anthonomus grandis*. In tests carried out in August in Mississippi, dusting increased the yield by 288 lb. seed cotton per acre, this being due partly to the development of heavier bolls on plants that had not been defoliated. The thurberia weevil [*Anthonomus grandis thurberiae*, Pierce] is unable to maintain itself exclusively on cultivated cotton under normal conditions in southern Arizona, and wholesale eradication of its native food-plant, *Thurberia thespesioides* is therefore being undertaken on the mountain ranges nearest the cotton-growing districts.

Parasites imported into the United States from Europe during the year included: *Copidosoma geniculatum*, Dalm., against the pine shoot moth (*Rhyacionia buoliana*, Schiff.); *Platygaster pleuron*, Wlk., and *Trichacis remulus*, Wlk., against *Mayetiola destructor*; *Chelonus annulipes*, Wesm. (also from Canada) against *Pyrausta nubilalis*; *Triaspis thoracicus*, Curt., against *Bruchus pisorum* [*cf.* **26** 65] and *B. brachialis*, Fhs.; and *Microbracon piger*, Wesm., and *Phanerotoma planifrons*, Nees, against the lima-bean pod-borer [*Etiella zinckenella*, Treit.]. *Exenterus abruptorius*, Thnb., and *Microplectron fuscipenne*, Zett., both parasitic on the spruce sawfly [*Diprion polytomum*, Htg.], and the Agromyzid, *Leucopis obscura*, Hal., predacious on *Chermes* (*Adelges*) *piceae*, Ratz., were introduced from Canada. Parasites imported into Porto Rico included *Anagyrus coccidivorus*, Doz., and *Hambletonia pseudococcina*, Comp., against the pineapple mealybug [*Pseudococcus brevipes*, Ckll.], *Pimpla* (*Exeristes*) *roborator*, F., against *Platyedra gossypiella*; and *Prospaltella berlesei*, How., against the white peach scale [*Aulacaspis pentagona*, Targ.]. A list is given of the parasites and predators shipped to foreign countries during the year.

Chemical investigations on insecticides and the removal of spray residues are briefly reviewed.

CRAWFORD (J. C.). **Some new or little known Thysanoptera.**—*Proc. ent. Soc. Wash.* **40** no. 2 pp. 35–43. Washington, D. C., February 1938.

Included in this paper is a description of *Gnophothrips piniphilus*, sp. n., from Long Island, N.Y., and Rhode Island. It is doing a great amount of damage to black pines, probably a variety of *Pinus nigra*, in nurseries on Long Island, stunting the needles of the current year's growth. Larvae, pupae and adults all occur in numbers on the growing tips of the branches.

FISHER (W. S.). **A new Anobiid Beetle (Coleop : Anobiidae) injurious to Books.**—*Proc. ent. Soc. Wash.* **40** no. 2 pp. 43–44. Washington, D. C., February 1938.

Neogastrallus librinocens, gen. et sp. n., is described from Florida, where both adults and larvae were found in numbers infesting books.

MUESEBECK (C. F.). **Two reared North American Species of the Genus *Stantonia* Ashmead (Hymenoptera : Braconidae).**—*Proc. ent. Soc. Wash.* **40** no. 3 pp. 89–91, 1 fig. Washington, D.C., March 1938.

Descriptions are given of *Stantonia lamprosemae*, sp. n., from adults of both sexes reared from *Lamprosema indicata*, F., in Cuba and a female taken in Porto Rico, and of *S. carpocapsae* sp. n., from a female reared from a cocoon of *Cydia* (*Carpocapsa*) *pomonella*, L., in Kentucky.

BALCH (R. E.). **Estimation of Spruce Sawfly Hazard and Need of Salvage.**—6 pp. Montreal, Woodlands Sect. Canad. Pulp Pap. Ass., 1938.

Suggestions are made for the collection of information on infestations of spruce [*Picea*] by *Diprion polytomum*, Htg., which is becoming more abundant and widespread in eastern Canada and the north-eastern United States. Both the condition of the trees and the abundance of the insect should be examined. Loss of foliage should be estimated according to the ease with which it can be seen (not noticeable, noticeable beneath the trees, noticeable at 100 ft. or more) and as a percentage of the normal foliage, both " old " and " new." The degree of infestation should first be estimated roughly from the amount of frass under the trees, then more accurately either by examining 1 sq. ft. samples of the moss and litter under the trees for cocoons in late autumn or before emergence begins in the spring, or by taking samples of larvae from the trees in summer by stretching a sheet, preferably 7 × 9 ft., beneath a tree and beating the branches above it with a pole. Ten samples in a stand should be sufficient. A specimen form for recording the information is shown. For the past six years, studies have been made on the interpretation of such data. The data obtained in 14 plots in various years are shown in tables, and some of the general conclusions that may be drawn from them are given, and also a table of the characteristics by which infestations may be classed as light, medium and heavy. The various factors influencing the desirability of salvage and its effect are discussed.

MARSH (F. L.). **Biology of the Tachinid *Winthemia datanae*, Tns.**—*Psyche* **44** no. 4 pp. 138–140. Cambridge, Mass., December 1937.

Notes are given on the bionomics of *Winthemia quadripustulata*, F. (*datanae*, Tns.), parasitising *Samia cecropia*, L., in the Chicago district, where about 3 per cent. of the host larvae were destroyed by it. Reasons why it is not a more effective parasite are its habit of ovipositing only on mature larvae, the failure of many of the larvae to escape from the host cocoon, and the great sensitiveness to dehydration of both the hibernating larvae and the pupae.

HOLADAY (D. A.). **Determination of Pyrethrin I in Commercial Insecticides containing Pyrethrum or Pyrethrum Extract.**—*Industr. Engng Chem.* (Anal. Edn) **10** no. 1 pp. 5–6, 4 refs. Easton, Pa, January 1938.

The author introduces a modification of Wilcoxon's method for the determination of pyrethrin I in pyrethrum powder [*R.A.E.*, A **25** 56] so that it can be used to determine pyrethrin I in insecticides

containing pyrethrum powder or pyrethrum extract with oils, derris resins and certain other materials. Full details of the procedure are given.

Jones (H. A.) & Graham (J. J. T.). **Determination of Rotenone in Derris and Cube. II. Extraction from the Root.**—*Industr. Engng Chem.* (Anal. Edn.) **10** no. 1 pp. 19–23, 12 refs. Easton, Pa, January 1938.

Jones (H. A.) & Graham (J. J. T.). **Determination of Rotenone in Derris and Cube. III. An improved Crystallization Method.**—*J. Ass. off. agric. Chem.* **21** no. 1 pp. 148–151, 3 refs. Menasha, Wis., February 1938.

In the first paper, results are presented of work on methods employed for the extraction of rotenone from derris and cubé with a view to finding the best procedure for use in conjunction with the method of crystallisation described in the preceding paper of this series [*R.A.E.*, A **26** 120]. The second paper gives in detail the procedure recommended for the analysis of finely powdered derris or cubé root for its rotenone content.

Changes in the Official and Tentative Methods of Analysis made at the Fifty-third Annual Meeting, November 1, 2, and 3, 1937.—*J. Ass. off. agric. Chem.* **21** no. 1 pp. 76–98. Menasha, Wis., February 1938.

Section VI (pp. 78–80) of this report deals with insecticides, fungicides and caustic poisons and includes descriptions of the methods noticed in the two preceding abstracts for the determination of pyrethrin I in pyrethrum powder and mineral oil pyrethrum extracts and the determination of rotenone in derris and cubé powder, which have both been tentatively adopted.

Nelson (O. A.) & Haring (M. M.). **Calcium Arsenates. An Investigation into the Three-component System Calcium Oxide—Arsenic Oxide—Water.**—*J. Amer. chem. Soc.* **59** pp. 2216–2223, 7 figs., 18 refs. Easton, Pa, 1937.

An account is given of an investigation of the three component system calcium oxide—arsenic oxide—water from the point of view of the phase rule. Evidence is presented for the existence of four compounds in such a solution, dicalcium arsenate $CaHAsO_4$, a compound between di- and tricalcium arsenate $Ca_5H_2(AsO_4)_4.5H_2O$, the tricalcium arsenate $Ca_3(AsO_4)_2.2H_2O$, and the tetracalcium arsenate $4CaO.As_2O_5.xH_2O$. In the brief discussion of hydrolysis and solubility of calcium arsenates with which the paper concludes, it is shown that probably the acid arsenates and the tricalcium arsenate react with water to form more basic solid phases, while the tetracalcium arsenate hydrolyses in the opposite direction. It is evident, therefore, that the solubility of an arsenate of calcium depends on the conditions under which the determinations are made. The ordinary usage of the term " solubility " of a compound implies an equilibrium condition between the solid and the solution, and also that the dissolved portion has the same chemical composition as the solid phase. With most calcium arsenates, the composition of the solid material after equilibrium is obtained depends on the quantity of water used, that is, the extent to which the salt has hydrolysed.

Fulton (R. A.) & Mason (H. C.). **The Translocation of Derris Constituents in Bean Plants.**—*J. agric. Res.* **55** no. 12 pp. 903–907, 3 refs. Washington, D.C., 15th December 1937.

In the course of investigations on the translocation of the constituents of derris from the treated leaves of bean plants to the first, second and third trifoliate leaves formed after treatment [*R.A.E.*, A **25** 287], 8 mg. rotenone were recovered from 800 gm. bean leaves that had been formed after spraying.

McIndoo (N. E.). **Quantitative Injection and Effects of Nicotine in Insects.**—*J. agric. Res.* **55** no. 12 pp. 909–921, 7 refs., 4 figs. Washington, D.C., 15th December 1937.

An account is given of experiments on the effects of injection of nicotine into the body cavities of insects. The following is based on the author's summary : The apparatus employed, which was extremely accurate, is described in detail. The comparative susceptibility to nicotine of various species and sexes of test insects was of the following descending order : adult males of *Lucilia sericata*, Mg., adult females of *L. sericata*, larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., adults of *Calliphora erythrocephala*, Mg., larvae of *Bombyx mori*, L., larvae of *Xylomyges* (*Prodenia*) *eridania*, Cram., and larvae of *Phormia regina*, Mg. Male adults of *L. sericata* were about nine times as susceptible as larvae of *P. regina*. In general, the larval forms were about half as susceptible as the adult forms. The susceptibility of adults of *Phormia* decreased rapidly from the first to the fourth or fifth day of life and afterwards increased rapidly ; flies 14 days old were 8 times as susceptible as those 5 days old. The male flies of this species were always more susceptible than the female flies of the same age. It is shown statistically that solutions of free nicotine were 22–26 times as toxic as solutions of nicotine sulphate containing the same percentage of nicotine, but when the nicotine in the latter was freed by means of potassium hydroxide, its toxicity was equal to that of the other free nicotine. The motor paralysis caused by the injections of nicotine was also studied.

Report of Progress for Year ending June 30, 1937.—*Bull. Maine agric. Exp. Sta.* no. 387, 262 pp. Orono, Maine, June 1937. [Recd. March 1938.]

This is the report of the Maine agricultural experiment station for 1936–37 and observations on insect pests are scattered throughout in association with various crops. During the past few years, *Lymantria* (*Porthetria*) *dispar*, L., has become increasingly injurious in apple orchards near infested woodlands. The apple trees become infested in three ways : by larvae that hatch from eggs overwintering on them ; by very young larvae that drift in air currents from woodland ; and by older larvae that crawl from woodland. Experiments on the effect of lead arsenate sprays against the larvae that hatch on or drift to the trees were carried out in 1936 and 1937. It appeared that the pink spray is more effective than the pre-pink ; 3 lb. lead arsenate per 100 U.S. gals. in the pink spray either killed the larvae outright, or protected the trees from material injury between the pink and the calyx applications. Larvae caused only slight injury, even on heavily infested trees, where 3 lb. lead arsenate was applied in the pink, calyx,

and first cover sprays. Where the previous sprays were omitted, 6 lb. lead arsenate per 100 U.S. gals. in the calyx spray killed all the larvae on the tree, whilst the same formula in the first cover spray killed the larvae very slowly. On trees where the pre-pink and pink sprays were omitted, the larvae caused distinct injury to fruit and foliage before the later sprays were applied. The influx of larvae drifting into the orchards was greatest during the latter part of the blooming period and very slight after the calyx spray.

Spray tests in commercial orchards showed that two applications of calcium arsenate against *Rhagoletis pomonella*, Walsh, gave very good control; where one application was omitted, there was a distinct increase in the percentage of infested apples. *Conotrachelus nenuphar*, Hbst., is a destructive pest of apples in Maine, where it has one generation a year. Details are given of its seasonal cycle in 1936, when experiments showed the calyx spray to be the most important. The application of lead arsenate in the calyx and first cover sprays effected a reduction in infestation of apples by *Syntomaspis druparum*, Boh.

Investigations with insecticides for the control of *Epilachna varivestis*, Muls., on beans indicate that a dust of copper sulphate and lime (2 : 8) is as effective as any other diluent for calcium arsenate; it apparently has a stimulating effect on bean plants, and a dust of calcium arsenate with it is cheaper than one of magnesium arsenate and lime. From experiments it would appear that a dust of 1 part calcium arsenate to 20 parts talc is satisfactory for controlling *Diabrotica melanocephala*, F. (*vittata*, F.) on cucumber; some growers are, however, already using a dust of copper sulphate and lime as a fungicide, and the incorporation of calcium arsenate in it would involve little additional labour in preparation.

Injury to blueberry bushes by calcium arsenate used against the blueberry fruit-fly (here called *Rhagoletis pomonella*, Curran [*cf. R.A.E.*, A **25** 471]) was investigated, and in an endeavour to find a substitute five acres of blueberry land were treated with derris dust (0·75 per cent. rotenone) applied at the rate of approximately 6 lb. per acre at each of two applications with a 10-day interval. At picking time, the berries from the dusted plot contained 9 maggots per 20 oz. berries, compared with 35 maggots on adjoining, untreated land—a reduction of 74 per cent. Although calcium arsenate usually gives somewhat greater reduction, the derris dust seems sufficiently promising to warrant further study. The excessive rainfall of the spring of 1937 seemed especially favourable for the development of *Frankliniella vaccinii*, Morgan, and tests were made of derris dust (5 per cent. rotenone), cubé dust (5 per cent. rotenone), sulphur dust, and poisoned bran bait for its control; none appeared to have any value. *Haltica torquata*, Lec., was a serious pest in the more westerly blueberry sections of the State.

SAUER (H. F. G.). **O apparecimento de *Phlyctaenodes bifidalis* (Fab.) como praga do algodoeiro no Brasil (Lep. Pyraustinae).** [The Appearance of *Loxostege bifidalis* as a Pest of Cotton in Brazil.]—*Arch. Inst. biol.* **8** pp. 201–210, 3 figs., 2 pls. S. Paulo, December 1937.

Larvae of the Pyralid, *Loxostege* (*Phlyctaenodes*) *bifidalis*, F., all stages of which are described, are fairly common in the state of São Paulo on *Amarantus*, *Portulaca* and *Talinum*, and in 1936 they

migrated to cotton, when some new cotton fields were cleared of these plants. In laboratory investigations, adults from larvae collected in the field paired, and the females deposited batches of about 11 eggs on the under-sides of leaves, usually during the night. The preoviposition and oviposition periods lasted 12–48 hours and 7–10 days, respectively, and the number of eggs deposited by a female averaged 274·5. At temperatures of about 24–25°C. [75·2–77°F.], the average durations of the egg, larval, prepupal and pupal stages were about 4, 18, 4 and 8 days.

LEVER (R. J. A. W.). **A preliminary Note on larval Parasites of the Spike Moth in Taveuni Islands.**—*Agric. J. Fiji* **8** no. 4 pp. 34–35, 3 refs. Suva, 1937.

Of larvae of *Tirathaba trichogramma*, Meyr. (coconut spike moth) collected in October 1937 from an estate on Taveuni (Fiji), 2·5, 0·8 and 41 per cent. were parasitised by *Apanteles* [*tirathabae*, Wlkn.], *Nemeritis* [*palmaris*, Wlkn.] and *Erycia* [*basifulva*, Bezzi], respectively [*cf. R.A.E.*, A **23** 608 etc.]. Despite the percentage of parasitism by *Erycia*, *T. trichogramma* is not yet under close control on certain parts of Taveuni. To the native parasites [*loc. cit.*] are added *Echthromorpha tirathabae*, Perkins [**25** 655] and *Antrocephalus renalis*, Wtstn.; the correct name for the Ichneumonid previously recorded as *E. diversor*, Morley, is stated to be *E. immaculata*, Krieger [of which *E. diversor* is a synonym].

MORGAN (W. L.) & LEVITT (E. C.). **Damage to Beans by Red Spider** (*Tetranychus telarius*). **Control Experiments.**—*Agric. Gaz. N.S.W.* **48** pt. 12 pp. 677–678, 2 figs. Sydney, 1st December 1937.

In one district in New South Wales, injury to beans by *Tetranychus telarius*, L., recurs every summer and is especially severe where beans are grown in succession so that the mite population builds up. In January and February, crops may have to be abandoned after the third or fourth picking, unless cool showery weather stimulates plant growth and checks infestation. Experiments on control were made on beans that had been sown on 26th November 1936 and were fairly heavily infested by 21st January 1937. Applications on 21st and 29th January of a dust of equal parts of fine sulphur and hydrated lime or a spray of 1 per cent. lime-sulphur increased the yield in the later part of the picking period by 49 and 37 per cent., respectively, and 6 and 4 weeks elapsed before reinfestation became serious. A 1 per cent. white oil emulsion was ineffective. The costs of treatment are discussed, and the dusting is considered to be economically practical, whereas spraying is not.

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **48** pt. 12 pp. 679–682, 6 figs.; **49** pt. 1 pp. 25–28, 7 figs. Sydney, 1937–38.

The first of these two parts of a series on insect pests in New South Wales [*cf. R.A.E.*, A **26** 209] includes brief notes on the tomato mite, *Phyllocoptes lycopersici*, Massee, the Psychids, *Hyalarcta huebneri*, Westw., which infests various trees and shrubs, and *Animula herrichi*, Westw., which attacks *Eucalyptus* in inland areas, and the Lymantriid, *Acyphas leucomelas*, Wlk. (*Porthesia hololeuca*, Meyr.), the larvae of

which sometimes feed on leaves of grape-vines during the summer and eat through the fruit stalks of young clusters. In addition to the sprays already recommended for the control of the mite [**23** 268], either wettable sulphur (1 lb. in 12 gals.) or colloidal sulphur (1 lb. in 50 gals.) may be added to Bordeaux sprays when these are regularly applied. Larvae of all the moths may be controlled by a spray of 1 lb. lead arsenate in 40 gals. water.

The insects discussed in the second part include the Coccinellid, *Leis conformis*, Boisd., the larvae and adults of which were particularly abundant in the spring of 1937 following early outbreaks of Aphids on which they are predacious; *Plusia chalcites*, Esp., the larvae of which sometimes partly defoliate beans, potatoes and other plants in coastal districts, and pupate in loose silken cocoons on the lower surface of the leaves; *Ceroplastes rubens*, Mask., which occurs on many native and introduced plants, and may be controlled on hardy shrubs by summer sprays of 15 lb. fresh washing soda or 5½ lb. soda ash in 40 gals. water with 2 lb. soap as spreader; and *Orthorrhinus cylindrirostris*, F. The last named is an indigenous weevil that is sometimes injurious to apple, apricot, *Citrus*, peach and grape-vines. The adults attack the buds and young bark; in uncultivated areas they have been observed to show a marked preference for freshly-fallen timber, when the bark is just beginning to wither. The eggs are deposited just beneath the bark, and the larvae tunnel downwards within the tree towards the roots. Towards the end of September they pupate in coarse cocoons of woody fibres within the tunnels, and the adults emerge about 3 weeks later. The exit holes in *Citrus* occur from 2 to 10 inches above ground level.

MORGAN (W. L.). **For Bean Fly Control use White Oil-Nicotine Sulphate Mixture.**—*Agric. Gaz. N.S.W.* **49** pt. 1 pp. 22–24, 4 figs. Sydney, 1st January 1938.

The bean fly [*Agromyza phaseoli*, Coq.] causes considerable damage to French beans in the coastal areas of New South Wales, particularly during the summer and autumn. The females oviposit in the leaves of the plants [*cf. R.A.E.*, A **13** 522], beginning as soon as they appear above ground. In the seedlings, the larvae mine the leaves for 1–2 days and then tunnel down the leaf-stalks to the base of the stems, feeding at ground level until they are mature. Pupation occurs within the stems. Severely infested plants containing 8–10 or more larvae are often killed, but in cases of light infestation, although the stems may become distorted, the plants may recover and cropping is often not affected. In older plants, the larvae occur in the fleshy joints of the branches and in leaf stalks.

The egg, larval and pupal stages were observed to last 2, 8 and 9 days in summer, and 12 days and 7 and 4 weeks, respectively, in winter. In captivity the flies usually lived 3–4 weeks, and the females laid about 100 eggs in 10–15 days, beginning 3–4 days after emergence. Experiments against the adults with bait-sprays, traps, contact sprays and repellents were unsuccessful in the field, but spraying with a 1 per cent. white oil emulsion containing nicotine sulphate (1 : 800) destroyed both the eggs and the larvae in the leaves. It is recommended that, where successive sowings are made at about weekly intervals, sprays should be applied twice to each crop, 4 and 8 days after the plants appear above the ground.

CHÛJÔ (M.). **Descriptions of two Hispid-beetles, belonging to a new Genus, from the South Sea Islands under Japanese Mandate (Coleoptera : Chrysomelidae).**—*Trans. nat. Hist. Soc. Formosa* **27** no. 169 pp. 222–228, 9 figs. Taihoku, October 1937. [Recd. March 1938.]

Planispa castaneipennis, gen. et sp. n., from Saipan (Marianne Is.) and *P.* (*Oxycephala*) *chalybeipennis*, Zacher [*cf. R.A.E.*, A **8** 254] from Ponape and Palau (Caroline Is.) are described and figured. Both Hispids attack the young shoots of palms, particularly coconut.

VOÛTE (A. D.). **Der Einfluss der Temperatur auf die Vermehrung der Insekten.** [The Influence of Temperature on the Increase of Insects.]—*Hand. 7. Ned.-Ind. naturwet. Congr.* pp. 472–480. 1 graph, 13 refs. Batavia, 1936. [Recd. 1938.]

The literature on the influence of temperature on the development of insects and the optimum temperature for them is briefly reviewed. Janisch considered the latter to be a temperature characterised by completion of the total life-cycle until physiological death in the shortest possible time, the highest production of fertile eggs, a uniformly small range of variation in all developmental stages, and no mortality except that caused by senility. The author suggests that the highest temperature at which no injury to the organism is due to thermal causes should be considered an optimum.

In experiments in Java to ascertain whether the optimum temperature is lower than that at which development is most accelerated, *Calandra oryzae*, L., was bred in rice at almost constant temperatures between 39 and 20°C. [102·2 and 68°F.] and about 70 per cent. relative humidity. The eggs had been laid at the breeding temperatures, except that none was laid above 36°C. [96·8°F.], at which temperature the mortality was so great that only one adult developed fully and two died during emergence from the rice. The duration of development was shortest at 32°C. [89·6°F.] and increased rapidly both above and below this. This process could well be represented by a catenary curve. When the offspring of adults that had been reared at 28°C. were reared at 28, 31 and 33°C. [82·4, 87·8 and 91·4°F.], they developed at the same rate as the weevils previously reared at these temperatures. On the other hand, when the offspring of adults reared at 31 and 33°C. were themselves reared at the same temperatures, all died before pupation. Of the larvae at 31°C., 54 per cent. developed almost up to the final moult, whereas only 31 per cent. of the larvae at 33°C. developed so far. Thus a second generation could not be completed at 31°C. or over. These temperatures were therefore harmful, and the optimum must lie between 28 and 32°C.

From these results and those recorded by other investigators, the author concludes that in some species of insects there is a zone, or perhaps a point, where temperature does not cause biological injury to the organism. In the case of *C. oryzae* the optimum is probably a zone, as the weevil develops without apparent injury up to an altitude of about 5,000 ft. in Java, the temperature at sea-level being very much higher than in the mountains.

Voûte (A. D.). **Die biologische Bekämpfung der Insekten in Niederl. Indien.** [The biological Control of Insects in the Netherlands Indies.]—*Naturk. Tijdschr. Ned.-Ind.* **97** pt. 2 pp. 28–34, 9 refs. Batavia, 1937.

Of beneficial insects introduced into the Netherlands Indies from abroad, *Cryptolaemus montrouzieri*, Muls., which was originally imported into Java [*R.A.E.*, A **7** 389], has now proved very successful against Coccids in Celebes, but the importation of *Prorops nasuta*, Wtstn., against *Stephanoderes hampei*, Ferr. [**12** 200] has proved a failure, and it is doubtful whether the Carabid, *Calosoma sycophanta*, L., predacious on Lepidopterous larvae [*cf.* **21** 208], has become established in Java.

Much more success has been obtained by the transport of parasites from one island to another within the archipelago. *Tetrastichus* (*Tetrastichodes*) *brontispae*, Ferrière, taken from Java to Celebes, has given good results against *Brontispa frogatti* var. *selebensis*, Gestro, on coconut [**23** 509]. In South Celebes, *Aleurodicus destructor*, Mackie, has been checked by a parasite from Java. In 1934, coconuts in Bali were severely injured by *Aspidiotus destructor*, Sign. Some Hymenopterous parasites (including *Aspidiotiphagus citrinus*, Crwf., and *Comperiella bifasciata*, How.) and a Coccinellid, *Chilocorus politus*, Muls., were brought from Java, and *A. citrinus* had controlled the Coccid by 1936. The results of the importation of various parasites from Java into Celebes against *Agrotis* (*Rhyacia*) *ypsilon*, Hfn., on maize [**23** 362] are uncertain.

King (C. B. R.). **The Long-tailed Parasite of Tortrix.**—*Tea Quart* **10** pt. 4 pp. 187–190. Talawakelle, December 1937.

Consignments of a species of *Macrocentrus* parasitising larvae of the tea tortrix [*Homona coffearia*, Nietn.] were received in Ceylon from Java in November 1935 [*R.A.E.*, A **24** 633] and September 1936. Most of the parasites were released at once, as it was not found possible to rear them in cages. By 1937, the Braconid had become well established in one district as a result of the first release and had spread considerably, the rate of parasitism being over 50 per cent. in some cases. It has therefore been able to survive the period of the south-west monsoon, during which *H. coffearia* is very scarce. Parasites collected in the field are being liberated in other localities. The eggs are deposited in the host larvae, and the parasite larvae become full-grown in about a month, when they leave the host and spin small cocoons on it, in which they pupate. The life-cycles of the host and parasite occupy about 10 and 7 weeks, respectively.

King (C. B. R.). *Neotermes militaris.*—*Tea Quart.* **10** pt. 2 pp. 195–205, 4 pls., 8 refs. Talawakelle, December 1937.

This paper on infestation of tea bushes by *Calotermes* (*Neotermes*) *militaris*, Desn., in Ceylon [*cf. R.A.E.*, A **26** 240] is largely based on the results of the individual examination of 27,962 bushes that were removed from a badly infested area, about 5 acres in extent, which had been planted to tea immediately after the jungle had been cleared about 50 years previously. Colonies in trees are usually founded by winged pairs, but it appears that a tea bush becomes infested only

when its lateral roots touch those of an adjacent plant [*cf.* **18** 156; **25** 46]. Thus, the termites occur in tea on one side of a river, which is only 10–20 yards wide, and in the course of about 50 years none has been found in tea on the other side. In experiments in which termites were buried in the soil a few inches from a tea bush, they gradually died without making any attempt to forage about, and it is thought that they do not travel through the soil in search of bushes. Close planting, therefore, increases the chance of infestation. It is possible that one colony may occupy more than one bush at a time; groups of as many as 11 bushes, all containing living termites, were found in the area investigated. It is thought that if several bushes are in subterranean contact, a colony may persist in them for a very long period, perhaps for hundreds of years. The duration of infestation of a single bush is, however, definitely limited. Of the bushes examined, 1,351 (4·83 per cent.) were occupied by living termites, and 3,438 (12·29 per cent.) had been infested and abandoned. If a colony stays in a bush for 15 years and then moves to a new one, the ratio of abandoned to infested bushes would be 3 : 1 after 46 years. As the ratio in the area studied was about 5 : 2, a bush is possibly occupied for more than 15 years.

In a newly infested bush, a channel is usually excavated from a lateral root to the main one, and then several are made into the main stem. Later the partitions separating these are gradually eaten away, and further galleries are driven up into the branches, where they may be seen when the trees are pruned. All the galleries are made in the heartwood, and living tissue is not attacked unless it becomes diseased. The damage is therefore purely mechanical, and it is considered that the injury caused by this species has been greatly exaggerated [*cf.* **19** 164], and that healthy bushes can sustain infestation and continue to grow and flush normally. The only infested bushes that were unhealthy suffered from extensive wood-rot. Sometimes growths of callus tissue partly fill the galleries.

Control measures include the eradication of infested bushes, including the entire root system. If all the infested bushes in a group are eradicated, the area may be replanted immediately; in the case of large areas that include both infested and uninfested bushes, cleared ground should be surrounded by a trench about 2 feet deep to prevent reinfestation. Injection of Paris green dust into the galleries [**18** 105] is effective, but if any of the powder remains on sound wood it may kill the living tissue [**24** 102]. Injection holes should therefore be drilled in the thickest part of the stem and not directly underneath a branch.

GARTHWAITE (P. F.). **Entomological Research.**—*Rep. Silv. Ent. Burma* 1936–37 pp. 93–103. Rangoon, 1938.

During 1936–37, studies on *Xyleutes ceramicus*, Wlk. (bee-hole borer) infesting teak [*Tectona grandis*] in Burma were continued [*cf. R.A.E.*, A **25** 454, etc.]. Of the moths recorded from the plot under observation from 1932 to 1937, 70 per cent. emerged after a single year as larvae, the remaining 30 per cent. emerging after two years. This proportion is probably related to the fact that only 8–9 per cent. of the larvae survived to pass into their second year. Each year from 1933 to 1936, 17–30 per cent. of the larvae transferred from one hole to another, generally in September or November of their first year.

In the period 1932–37, about 4·7 per cent. of the larvae of each generation that attacked any tree gave rise to moths. Males comprised 76 per cent. of the emerging moths, about the same proportion as that recorded from random counts of pupal skins. There is evidence that emergence occurs later in the north than in the south. Emergence records are given for 2 localities. In one of them, 225 moths emerged within an area of a square mile containing scattered groups of teak 40–100 years old ; 26 per cent. of the moths were females. The number of moths emerging was unprecedentedly large, and emergence was extremely local ; hundreds of trees were searched, but less than 10 moths were found to have emerged from trees other than those in and about a village. It is not known how much ground a female covers in ovipositing, but in 1934–36, when only one female per year was known to have emerged in an acre plot, attack was widespread over the 245 trees in it. Preliminary studies suggested that when a satisfactory site has been found, the female continues to lay there until the crevice is full of eggs, depositing up to 1,000 in one place. Eggs hatched in 12–22 days according to the locality. The average maximum and minimum temperatures during April, when hatching occurred, were 97·7 and 66·8°F., respectively. Larvae placed on the ground near teak did not show any positive tropism towards it. The highest population was present in the trees in July–August of each year, and natural control was most effective in September–November and March–April in each generation. Control measures should therefore be applied before September. Pupal skins and living pupae of *X. ceramicus* were taken from *Gmelina arborea* ; emergence had occurred a day or two previous to 22nd February. In another locality larvae were introduced into *G. arborea* and were flourishing in June 1937. *G. arborea* would therefore seem to be an alternative food-plant. The Ichneumonid parasite, *Nemeritis tectonae*, Perkins [*cf.* **25** 455], parasitises *X. ceramicus* in June and July when other natural control is absent. Its breeding in the insectary is to be started with a view to its colonisation in large numbers. Ants and termites are important natural enemies of the borer, destroying exposed larvae and eggs.

A stock of *Cedria paradoxa*, Wlksn., a Braconid parasite of the teak defoliator, *Hapalia machaeralis*, Wlk., was received from Madras, having been transported in cold storage in the adult stage. Breeding is being carried on in Burma, and several colonies have already been liberated. *Gmelina arborea* was attacked by *Phassus* sp., adults of which emerged from late September to mid-October ; all the trees attacked were associated with the creeper, *Buettneria pilosa*, from which the larvae had evidently originated [*cf. loc. cit.*]. In captivity, adults of this Hepialid died within two days. Field observations of infestation of *Xylia dolabriformis* by a Cerambycid of the genus *Pachydissus* corroborated evidence from the mills that unclassed forests are attacked to a greater extent than reserves, but infestation was not severe nor the loss caused by it great. *Pachydissus* attacked living trees over 2½ft. in girth, and no galleries were found more than 40 ft. from the ground. Adults emerged in late April 1937 from billets that contained well-grown larvae in May 1936. In one district *X. dolabriformis* was infested by the Lamiid, *Aristobia approximata*, Thoms., which attacked trees less than 10 years old. *Minthea rugicollis*, Wlk., is the most common of the Lyctids bred from material in Burma. The flowering of bamboo over large tracts of forest led to an enormous population of the Pentatomid, *Ochrophara montana*, Dist., which feeds on its seeds.

Cassia fistula and *C. renigera* in Rangoon and elsewhere were attacked by *Xyleutes persona*, Le Guillou. From one tree, 106 pupal cases were taken in March; fresh pupal skins have been taken in most months of the year. This is consistent with the variable length of larval life ($1\frac{1}{2}$–$2\frac{1}{2}$ years) recorded for individuals in caged trees. Larvae of several sizes are found within the same tree.

It was reported from the Shan States that seedlings of *Aleurites fordi* and *A. montana* in nurseries suffered from attack by crickets (*Brachytrypes* sp.), against which poison baits were recommended, and by the Curculionid, *Astychus lateralis*, F., and that *Hypsipyla robusta*, Moore (toon shoot borer) had destroyed completely 126 acres of plantations of *Cedrela toona*.

PRUTHI (H. S.). **Further Record of the Occurrence of Codling Moth in India.**—*Agric. Live-Stk India* **8** pt. 1 pp. 42–43, 1 ref. Delhi, January 1938.

The codling moth [*Cydia pomonella*, L.], recorded in Baluchistan in 1935 [*R.A.E.*, A **24** 72], has since been observed in several localities in the North West Frontier Province, where it has caused considerable damage to apples and pears, and has been found infesting apples imported from Afghanistan.

JOURDAN (M. L.). **Les insectes parasites de la cécidomyie destructive au Maroc.**—*C. R. Soc. Sci. nat. Maroc* no. 8 p. 53. Rabat, 1938.

The parasites of *Mayetiola destructor*, Say, in Morocco are *Platygaster hiemalis*, Forbes (*minutus*, Lind.), *Eurytoma atripes*, Gah., *Eupelmella vesicularis*, Retz., species of *Eupelmus*, *Pleurotropis*, *Amblymerus*, *Meraporus* and *Semiotellus*, and an undescribed Chalcidoid. *Meraporus*, *Semiotellus* and *Platygaster hiemalis* were the only parasites taken before 1936. *P. hiemalis* is the most widely distributed and is an important factor in the control of *M. destructor* in certain years [*cf. R.A.E.*, A **20** 452]. In February 1937, 50 per cent. of a batch of pupae were parasitised by it.

VIDAL (J.). **Observations sur la biologie de** *Monosteira unicostata* **Muls.**—*C. R. Soc. Sci. nat. Maroc* no. 8 pp. 53–54. Rabat, 1938.

Observations on the biology of the Tingid, *Monosteira unicostata*, Muls. & Rey, which has caused injury to apple and pear in north Africa for several years, were made in eastern Morocco in 1937. It was observed on plum, apricot, cherry, almond, apple, pear and *Populus* spp. The egg and nymph are briefly described. The eggs are deposited singly or in groups in the parenchyma along the main veins on the lower surface of the leaf. A female lays 6–15 eggs in one leaf. The egg and nymphal stages last 13–15 and 25–30 days, respectively, and there are five moults, the nymphal skins remaining attached to the leaf. The whole of the nymphal stage is usually passed on one leaf. The number of generations a year has not been determined, but there may be only two, the adults being active in early May and early August. In the latter month, a period of protracted oviposition begins, and all stages are present until December. The Tingid is most abundant and injury most severe in September.

The winter is passed in the adult stage in cracks in the trunk of the tree or in the soil. The hibernation period lasts from the end of December till the second half of April.

Bleton (C.). **Notes succinctes sur la biologie de** *Carpocapsa pomonella* **L. (Lépidoptères Tortricidae) dans la région de Fès.**—*C. R. Soc. Sci. nat. Maroc* no. 8 pp. 54–55. Rabat, 1938.

Cydia (*Carpocapsa*) *pomonella*, L., has only two generations annually on apple in northern Morocco, the winters being wet and cold. Adults emerge from overwintered cocoons from 20th April to 20th May, pairing and oviposition take place in May and June, larvae are present from May to July, and first generation adults emerge from 20th June to 30th July. These adults pair and oviposit from the end of July to the end of August, second generation larvae are present from August to October, and cocoons from September onwards.

Roebuck (A.). **Grassland Pests in the Midland Counties.**—*Rep. 4th int. Grassl. Congr. Aberystwyth* pp. 280–285. Aberystwyth, 31st December 1937. (With a Summary in German.)

The invertebrate fauna of grassland is considerably more numerous in individuals and species than that of arable land. Of those that live in the soil, a high percentage, over 65 per cent., is found in the top one-and-a-half inches, whereas on arable land less than 25 per cent. are in this part. This is one reason why insectivorous birds prefer to frequent grassland rather than arable land. Lists are given of the insects and other invertebrates found in grassland in the Midland counties of England, with notes on the feeding habits of some of them. They are divided into three groups and are again sub-divided into two according to whether they attack grasses or leguminous plants. The members of the first group attack from the ground level downwards ; most of them are root-feeding larvae that may sever the roots and destroy the herbage. Those of the second attack the vegetative parts above ground by boring in the stems, eating the leaves and stems or piercing the tissues and feeding upon the cell fluids ; they reduce the quantity of herbage and the seed-yield. Those of the third group attack the flowering parts and fruits ; they are mostly small insects that directly destroy flowers and seeds.

Morris (K. R. S.). *Eupelmella vesicularis* **Retz. (Chalcididae) as a Predator of another Chalcid,** *Microplectron fuscipennis* **Zett.**—*Parasitology* **30** no. 1 pp. 20–32, 5 figs., 3 refs. London, 25th February 1938.

The following is the author's summary : *Eupelmella vesicularis*, Retz., was found in certain parts of Hungary infesting cocoons of *Diprion sertifer*, Geoffr., already parasitised by a primary parasite, *Microplectron fuscipenne*, Zett. It was never found in the absence of this Chalcid. Experiments showed that *Eupelmella* confined itself almost exclusively to *Microplectron* as a host, easily detecting the presence of larvae or pupae of this parasite within the cocoons of the sawfly host, but neglecting eggs. A single egg is laid per cocoon and the larval *Eupelmella* eats from 10 to 20 *Microplectron* larvae or pupae, and finally kills all the remaining living parasites within the

cocoon before pupating. The egg and larva show interesting structural adaptations for this mode of life. Reproduction is parthenogenetic and no males are known. Several factors combine to make this insect a dangerous enemy of *Microplectron* capable of seriously impairing its efficiency. These are : its selective ability, its destructive powers, its rapid rate of increase due to the parthenogenetic habit, and its ability to establish itself and survive on small numbers of the prey, for the same reason.

Bisset (G. A.). **Larvae and Pupae of Tachinids parasitising** *Pieris rapae* **L. and** *P. brassicae* **L.**—*Parasitology* **30** no. 1 pp. 111–122, 37 figs., 11 refs. London, 25th February 1938.

Descriptions are given of the puparia and one or more larval instars of Tachinids obtained from larvae and pupae of *Pieris rapae*, L., and *P. brassicae*, L., on cabbage in Buckinghamshire. They comprise *Zenillia* (*Phryxe*) *vulgaris*, Fall., and *Compsilura concinnata*, Mg., from both Pierids, and *Epicampocera succinta*, Mg., and *Zenillia* (*Phryxe*) *nemea*, Mg., from *P. rapae*. The first instar of an unidentified (possibly Miltogrammine) larva from *P. brassicae* is also described.

Wilkinson (D. S.). **On the Identity of** *Apanteles circumscriptus* **Nees (Hym., Braconidae).**—*Proc. R. ent. Soc. Lond.* (B) **7** pt. 3 pp. 41–51, 2 figs., 38 refs. London, 15th March 1938.

The synonymy and host records are discussed in detail and both sexes are described of *Apanteles circumscriptus*, Nees. The name *A.* (*Microgaster*) *bicolor*, Nees, which has been used for this species [*cf. R.A.E.*, A **17** 573], is preoccupied by *Microgaster bicolor*, Curt. [which is a synonym of *Macrocentrus abdominalis*, F.].

Watson (M. A.). **Further Studies on the Relationship between** *Hyoscyamus* **virus 3 and the Aphis** *Myzus persicae* **(Sulz.) with special Reference to the Effects of Fasting.**—*Proc. roy. Soc.* (B) **125** no. 838 pp. 144–170, 14 refs. London, 3rd March 1938. (Abstr. in *op. cit.* (B) **124** no. 837 pp. S67–S68. London, 14th January 1938.)

The following is the abstract referred to in the title : The aphides (*Myzus persicae*) are much more likely to transmit *Hyoscyamus* virus 3 [*cf. R.A.E.*, A **21** 2] if they are made to fast immediately before feeding on the source of infection. Their efficiency as vectors increases rapidly during the first hour of fasting, but the rate of increase is much slower during the following 12 hours. The increase in efficiency induced by such preliminary fasting decreases as the infection feeding period is increased, and after one hour's feeding on the infected plants preliminary fasted aphides give no more infection than do continuously fed aphides. Infectivity is lost by the aphides after the cessation of infection feeding, and the rate of loss is probably more rapid than the rate at which the virus deteriorates *in vitro*. This loss of infectivity is complete in one hour if the aphides do not fast before infection feeding, or if they are fed on an intermediate healthy plant between the infection feeding and the infection trial ; but if they fast both before and after the infection feeding, the relative rate of loss of infectivity is slower, and a few insects may remain infective for many hours. The infectivity of an Aphid is greater after two or more

successive infection feedings of equal length unless the treatment given between the feedings is such that all the infectivity is lost. The infectivity actually acquired at the second or third infection feeding is, however, less than that acquired at the first, because the feeding activity of the Aphid is decreased by the experimental conditions. The effect of preliminary fasting appears to be independent of feeding activity or "appetite," and is very much more important. It is possible to explain these results if it be assumed that, during the process of transmission from one plant to another in the recently fed Aphid, the virus comes into contact with some substance which partially or wholly destroys its infectivity. The possible nature of this substance is discussed.

Hus (P.) & others. **Handleiding voor de bespuiting van vruchtboomen.** [Instructions for the Spraying of Fruit Trees.]—*Versl. Meded. PlZiekt. Dienst Wageningen* no. 86, 29 pp. Wageningen, April 1937. [Recd. 1938].

This is a general account intended for fruit-growers in Holland of the commoner insecticidal and fungicidal sprays and their composition and use. Those dealt with comprise tar distillates (fruit-tree carbolineums), mineral oil emulsions, mixtures of both of these, lead arsenate, nicotine, Bordeaux mixture and lime-sulphur. The insects or fungi against which each is effective are indicated. Some general information is added on spreaders, apparatus and conditions for spraying.

Poisson (R.). **Quelques observations biologiques et morphologiques sur** *Ceresa bubalus* **(Fab.). Insecte Hémiptère-Homoptère de la famille des Membracides, d'origine américaine.**—*Bull. Soc. sci. Bretagne* **14** hors série pp. 32–50, 12 figs., 29 refs. Rennes, February 1937. [Recd. 1938.]

Instances are quoted from the literature of the occurrence in France and Hungary [*R.A.E.*, A **19** 178, 423] of *Ceresa bubalus*, F., which is common on fruit trees in the United States [*cf.* **22** 349]. Since 1927, this Membracid has been observed in a locality in Pyrénées-Orientales, where the females oviposit in September in branches of apple, peach, almond and willow. Detailed descriptions are given of the male and female genitalia, the process of oviposition and the egg. Considerable injury may be caused to trees by the incisions into which the eggs are inserted. The only method of control seems to be to cut off and burn the injured branches.

Giavarini (I.). **Acari delle api e dell'alveare.** [Acari of Bees and of the Hive.]—*Atti 4. Congr. naz. S.A.I., Roma 17–20 Nov. 1935*, preprint 12 pp., 2 figs., 36 refs. Trento, 1936. [Recd. 1938.]

The literature on the mites parasitising honey bees or found in hives is surveyed. In North Italy, the author has observed *Acarapis dorsalis*, Morgenthaler, on bees, some but not all of which were also parasitised by *A. woodi*, Rennie, but has so far failed to find *A. externus*, Morgenthaler. In 1926–27 at Portici, Morgenthaler noted a mite that had the measurements of *A. externus*.

Örösi-Pál (Z.). **Über die Artfrage, Ernährung und Lebensweise der auf Honigbienen gefundenen *Meloë*-Triungulinen.** [The specific Identity, Nourishment and Habits of Larvae of *Meloë* found on Honey Bees.]—*Z. Parasitenk.* **9** no. 1 pp. 20–27, 1 fig., 18 refs. Berlin, 1936. [Recd. 1938.]

Örösi-Pál (Z.). **Über die Ernährung der Triungulinen der *Meloë*-Arten, insbesondere des *Meloë proscarabaeus* L. (Coleoptera).** [The Nourishment of Larvae of Species of *Meloë*, particularly of *M. proscarabaeus*, L.].—*T.c.* no. 5 pp. 674–676, 3 refs. Berlin, 1937.

The first paper includes brief descriptions of the larvae of six species of *Meloë* that infest honey bees [*cf. R.A.E.*, A **22** 196]. Experiments in Hungary in which young larvae of *M. variegatus*, Don., were allowed to attach themselves to honey bees of which the body fluid was dyed showed that they bored into the intersegmental interstices and fed on the body fluid. They refused bees' eggs.

The second paper contains an account of similar experiments on larvae of *M. proscarabaeus*, L. The results were negative.

Francke-Grosmann (H.). **Ueber *Dreyfusia piceae* an ausländischen Tannenarten.** [*Chermes piceae* on foreign Silver Firs.]—*Tharandt. forstl. Jb.* **89** pt. 1 pp. 35–49, 12 figs. Berlin, 1938.

The death or poor growth of *Abies pectinata* in Germany has led to a desire to replace it by suitable foreign silver firs, such as *A. grandis*, but success will depend on their ability to resist attack by species of *Chermes* (*Dreyfusia*). The behaviour of *C.* (*D.*) *piceae*, Ratz., on many foreign firs is not the same as on *A. pectinata*; the bark of the stems and branches is comparatively little infested, the attack being mainly at the base of the shoot buds of fairly young trees [*cf. R.A.E.*, A **13** 534]. Observations on several species of *Abies* have been made at Tharandt over a period of years in order to ascertain which tissues are involved, and the results are recorded in detail. Firs that do not grow well in Germany must be rejected on that ground, as well as because of susceptibility to attack by *C. piceae*. Some of the trees, however, such as certain climatic races of *A. grandis*, may grow well in favourable localities, and it can be assumed that where they develop strong shoots and buds they will be able to withstand attack. *A. grandis* is best suited to open areas, and would be more susceptible to infestation under shaded conditions.

Gäbler (H.). *Otiorrhynchus* (*Peritelus*) *hirticornis* **Hbst. als Forstschädling.** [*O. hirticornis* as a Forest Pest.]—*Tharandt. forstl. Jb.* **89** pt. 1 pp. 67–71, 4 refs. Berlin, 1938.

The literature on the food-plants of *Otiorrhynchus hirticornis*, Hbst., is briefly reviewed; this weevil does not appear to have been recorded hitherto as a forest pest, and there is some evidence that the larvae develop on roots of bilberry [*Vaccinium myrtillus*]. In 1936, the author observed the adults near Tharandt attacking the foliage of mountain ash [*Sorbus aucuparia*], beech, oak and willow [*cf. R.A.E.*, A **25** 490]. They were subsequently reported from the province of Hanover as attacking young spruce and larch as well as oak and birch. Attack on the spruce buds extended from the tip to one-third of their length downwards. When offered a mixed batch of twigs, caged

weevils from Tharandt and Hanover refused pine and ate poplar only slightly. Oak, beech, hawthorn, ash, lime and willow were attacked about equally, and larch needles were eaten to a limited extent. The young May growth of spruce was slightly attacked. The deciduous leaves were always eaten from the edge. When bilberry, beech and oak were offered together, feeding was almost entirely confined to bilberry if it was sufficiently plentiful. It is concluded that *O. hirticornis* normally feeds on bilberry and extends its attacks only if its numbers are largely increased.

THIEM (H.). **Über die insektentötende Wirkung von Detal als Staubmittel.** [The Insecticidal Effect of Detal as a Dust.]—*Zbl. Bakt.* (2) **96** no. 9–12 pp. 221–230, 1 fig. Jena, May 1937. [Recd. April 1938.]

The following is taken from the author's conclusions from experiments in which earwigs [*Forficula auricularia*, L.] were exposed to the action of Detal, a proprietary dust insecticide containing dinitro-cresol [*cf. R.A.E.*, **25** 525]. Applications to the tarsi or antennae proved fatal. The fact that the initial effect is paralysis indicates that the poison acts on the nervous system. Detal was more effective when dry than when moistened with water. The earwigs did not avoid the dusted surfaces, but occasionally discarded their paralysed legs.

HÄRDTL (H.). **Die Wirkung eines Schilfeulenbefalls an Typha-Bestanden.** [The Effect on *Typha* of Infestation by a Noctuid.]—*Z. PflKrankh.* **48** pt. 2 pp. 59–63, 2 figs., 8 refs. Stuttgart, February 1938.

The author records injury by the Noctuid, *Phragmatiphila* (*Nonagria*) *typhae* var. *fraterna*, Bkh., to *Typha latifolia* at Ohlisch, North Bohemia, in view of the fact that in Germany the heads of this rush are used for the production of a substitute for kapok. The larvae fed on the tender, folded leaves, which subsequently bent over at the injured point. A new growth from shoots put out by the infested plants developed to normal size, but did not flower. A possible measure for control may be cutting down the previous year's plants in spring prior to new growth.

BLUNCK (H.). **Das Schrifttum über die Möglichkeiten zur Bekämpfung der Maikäferengerlinge mit mechanischen und chemischen Mitteln.** [The Literature on the Possibilities of combating May Beetle Larvae mechanically and chemically.]—*Z. PflKrankh.* **48** pt. 2 pp. 64–87, 1 diagr., 5 pp. refs. Stuttgart, February 1938.

In previous papers the author reviewed measures against the adults of *Melolontha* spp. [*R.A.E.*, A **25** 488 ; **26** 250]. He here surveys the literature on mechanical and chemical methods against the larvae and concludes that at present there are no economically feasible chemical measures for destroying or repelling them. The collection of larvae from the ground beneath withering beets and dying grass or by following ploughs gives some control.

THIEM (H.). **Zur Gestaltung der Maikäferbekämpfung.** [Regarding the Future of May Beetle Control.]—*NachrBl. dtsch. PflSchDienst* **18** no. 2 pp. 9–11, 2 maps. Berlin, February 1938.

The author discusses Blunck's conclusions as to the possibility of controlling *Melolontha* spp. by collection of the adults [*R.A.E.*, A **25** 488], and considers that the application of this measure is more a technical than a scientific problem ; it requires subsidies and labour provided by the state. Its effect is best estimated by examinations of the crops for eggs and larvae.

EIDMANN (H.). **Neue Untersuchungen über die Nonne. Ein Ueberblick über die Arbeiten des Zoologischen Instituts der Forstl. Hochschule Hann.-Münden.** [Recent Investigations on the Nun Moth. A Survey of the Papers from the Zoological Institute of the Forestry High School at Münden (Hanover).]—*Anz. Schädlingsk.* **14** pt. 2 pp. 13–18, 19 refs. Berlin, February 1938.

This review of miscellaneous studies on *Lymantria monacha*, L., in Germany is compiled from papers published in 1935–37, many of which have been noticed [*R.A.E.*, A **23** 623 ; **24** 339, 404, 536, 750 ; **25** 200, 526].

RIETH (G.). **Ein Versuch zur Vergrämung von Maikäfer-Weibchen.** [A Test of Repellents against Female May Beetles.]—*Anz. Schadlingsk.* **14** pt. 2 pp. 18–21, 2 plans. Berlin, February 1938.

In 1937, substances stated to repel ovipositing females of *Melolontha* spp. were tested against *M. melolontha*, L., in two localities in the Hohes Venn plateau of Germany. The females began to oviposit on 23rd May, and the repellents were applied next day on plots separated by untreated land of at least the same area.

Kainit at the rate of about 1,000 lb. per acre completely failed to repel the beetles, as did rags soaked every two days in lysol or carbolic acid and suspended in intersecting lines about a foot above the ground. Quick-lime was effective on the first evening, but not on the second, being apparently slaked by air and soil moisture. Naphthalene, strewn at the rate of about 88 lb. per acre, kept the beetles away throughout the entire flight-period. When the soil was searched for larvae in October and November, the plot treated with naphthalene was the only one in which none was found.

SPEYER (W.). **Tätigkeitsbericht der Biologischen Reichsanstalt für Land- und Forstwirtschaft, Zweigstelle Stade . . . vom 1. April 1936 bis 31. März 1937.** [Report from 1st April 1936 to 31st March 1937 of the Stade Branch of the Imperial Biological Institute for Agriculture and Forestry.]—*Altländer Obstb. u. Landw.* nos. 49 & 59 repr. 4 pp. [Jork, 1937.]

This report of investigations in the orchard districts of the Lower Elbe contains some information already noticed [*R.A.E.*, A **24** 486 ; **25** 128]. Of pupae of *Rhagoletis cerasi*, L., from larvae bred in 1933, 82 per cent. gave rise to adults in 1934, 5·7 per cent. in 1935, and

3·2 per cent. in 1936. Adults had not yet emerged from some apparently healthy pupae. As soil treatment against the pupae, an 8 per cent. emulsion of a tar distillate proved satisfactory. Adults were able to work their way to the surface of marshland soil from a depth of 2 inches, so that the absence of the fly in the Altländer cherry orchards cannot be explained solely by the heavy marsh soil. The infestation of potato by *Leptinotarsa decemlineata*, Say, discovered at Stade in 1934 [**22** 560] has now been eradicated. *Aphelinus mali*, Hald., is well established [*cf.* **23** 717], but as the woolly apple aphis [*Eriosoma lanigerum*, Hsm.] increases in spring and autumn more rapidly than the parasite, other measures against it cannot be wholly discarded.

Greimer (K.) & Michael (H.). **Handbuch des praktischen Desinfektors. Ein Leitfaden für den Unterricht und ein Nachschlagebuch für die Praxis.** [Hand-book of the practical Disinfector. A Text-book for Teaching and a Reference Book for practical Work.]—Demy 8vo, xii+203 pp., 44 figs. Dresden, T. Steinkopff, 1937. Price *M.* 6.

About one-third of this hand-book deals with Arthropod pests associated with houses and stored products in Germany. It includes sections on their biology and control, and a review of the German regulations relating to poisonous fumigants.

Fransen (J. J.). **De gevoeligheid der overwinterende rupsen van den bastaardsatijnvlinder voor poedervormige contactvergiften.** [The Sensitivity of the hibernating Larvae of *Nygmia phaeorrhoea* to Dust Poisons.]—*Tijdschr. Ned. Heide-Mij.* **49** pt. 7 pp. 203–216, 2 figs., 19 refs. Utrecht, July 1937.

Fransen (J. J.). **Bestrijding der rupsen van den bastaardsatijnvlinder met poedervormige insecticiden in de praktijk.** [Control of the Larvae of *N. phaeorrhoea* with Dust Insecticides in Practice.]—*T.c.* pt. 8 pp. 272–276, August 1937. [Recd. March 1938.]

The author discusses the results of various observations on the overwintered larvae of *Nygmia phaeorrhoea*, Don., made in Holland in the spring of 1937, including data on such points as the number of instars they had completed and the way in which they resume activity and feed. He found that the larvae were able to survive for a long time without food and could crawl for considerable distances from their winter nests in search of it. At the end of April, he carried out experiments on active larvae with several poison dusts, mainly derris and pyrethrum, using a special dusting box [*R.A.E.*, A **26** 254]. Single applications of pyrethrum powder containing 0·45 per cent. pyrethrins at a rate equivalent to about 15 lb. per acre caused mortalities of 91 and 98 per cent. A powder containing only 0·15 per cent. was less effective, but one application at the rate of about 45 lb. per acre gave 100 per cent. mortality, and two applications, each at the rate of about 7½ lb., gave 81. Dusts of derris and *Lonchocarpus* containing 0·5, 0·75 and 1 per cent. rotenone proved inadequate.

In the second paper are described a series of field tests, also referred to in the first, in which rows of infested oaks bordering a road were power dusted with insecticides at an approximate rate of 45 lb. per acre on 7th or 10th May. The treatments were largely ineffective, as all the trees were heavily infested on 26th May, but, so far as could be

ascertained, they contradicted the laboratory tests, as derris dust (0·75 per cent. rotenone) appeared to have been more effective than pyrethrum containing 0·45, 0·15 or 0·3 per cent. pyrethrins, which seemed to be effective in that order.

FRANSEN (J. J.). **De bestrijding van de dennenbladwesp** (*Diprion pini* **L.).** [The Control of the Pine Sawfly.]—*Tijdschr. Ned. Heide-Mij.* **49** pt. 11 pp. 395-410, 7 figs. Utrecht, November 1937. [Recd. March 1938.]

The results are given of investigations in Holland on dust insecticides for the control of larvae of *Diprion pini*, L., on pines. In the laboratory, pyrethrum, derris and *Lonchocarpus* dusts were effective against the larvae, but barium fluosilicate was not. A pyrethrum dust containing 0·15 per cent. pyrethrins, applied at the rate of 30 lb. per acre did not give sufficient control, but a dust of which the pyrethrin content was 0·45 per cent. applied at the same rate was so effective that it is thought that a rather weaker dust might have been efficient. *Lonchocarpus* dusts (rotenone contents 1, 0·75 and 0·5 per cent.) were less effective than derris powders of the same rotenone content [*cf. R.A.E.*, A **25** 652]. In groups of larvae, the younger individuals were to some extent shielded against the dust by the older ones and so were less affected by it. Derris and *Lonchocarpus* are preferable to pyrethrum because larvae poisoned with them die slowly and do not shrivel or rot, so that parasites in them are not destroyed.

In field experiments, derris again appeared to be more effective than *Lonchocarpus* at a given rotenone content. In some tests, larvae recovered from dusting; of those that were collected some fed and eventually gave rise to adults, while others died as a result of infestation by the fungus, *Beauveria bassiana*, or parasitism by the Tachinids, *Sturmia inconspicua*, Mg., and *Diplostichus tenthredinum*, Br. & Berg. One sawfly cocoon contained an Ichneumonid, *Holocremnus frutetorum*, Thoms., new to Holland. It is sometimes advisable to use a dust of low rotenone content to ensure a more uniform distribution of the poison in the dust mixture [**25** 735]. In one set of tests, two applications of small quantities of dust of low rotenone content were more satisfactory than one of a dust of high rotenone content. Several applications seem necessary to destroy all the larvae.

FRANSEN (J. J.). **Een en ander over den dennenscheerder en zijn bestrijding.** [Notes on *Myelophilus piniperda* and its Control.]—*Tijdschr. Ned. Heide-Mij.* **49** pt. 9 pp. 285–297; **50** pt. 1 pp. 13–21, 1 fig., 1 plan. Utrecht, September 1937, January 1938.

The Scolytid, *Myelophilus piniperda*, L., is a serious pest of pines in Holland. Trap trunks are used for control, but the females do not oviposit in them if they are already infested to such a degree that their larvae would lack food. Moreover, the bark must be removed in time to prevent the larvae in them from maturing, and as there is usually no felling in summer, infestation by females flying in late summer is not controlled.

These disadvantages have been overcome by the author when using trap trunks against the elm bark-beetles [*Scolytus scolytus*, F., and *S. multistriatus*, Marsh.] by enclosing the trunks in muslin and painting stripes of banding adhesive about 19 inches apart on it. Elm bark-beetles that fly to a trunk do not penetrate the muslin, but crawl

over it and so are caught by the adhesive. Such covered trunks can therefore remain throughout the summer without danger. In tests of this method against *M. piniperda* in 1937, the beetles appeared to be as numerous on the protected trunks as on uncovered ones and could easily be collected from the muslin, but few were caught on the adhesive, partly because it was of poor quality and partly because they did not crawl about much. A very few bored through the muslin, but only if they were confined in a fold or unable to move freely.

In one series of observations, adults of the overwintered generation flew only when the temperature in the wood was about 11·5°C. [52·7°F.] and had a brief flight period, between 3rd and 16th April. In another wood, nearly half the bore-holes observed during the total flight period from 2nd to 27th April were made from 5th to 12th April. The trap trunks are therefore attacked almost contemporaneously, and any deficiency in them cannot be supplied in time by further fellings. It is necessary to continue these experiments, for a series of days with temperatures below 11°C. [51·8°F.] may well cause the beetles to appear in a series of flights over a longer period than has been recorded. Having oviposited, the females leave the trunk, continue feeding, and oviposit again ; in 1937, the majority had emerged before any of the young adults, and all had left by about 18th June. The emergence of the entire generation of young adults occurred in June–July in the course of about a month, in a series of flights of which the main ones took place on especially warm, but not necessarily sunny, days with temperatures of 16–22°C. [60·8–71·6°F.].

Bark removed from logs or dead trees at an early date may be left lying in the forest, as birds and other enemies destroy the larvae in it, which, moreover, are in any case weak and exposed to adverse conditions. If the bark is removed late, the larvae are already sheltered in their pupal chambers. No beetles emerged from bark removed between 15th and 21st May, but many did so from bark removed on 8th June.

Hodson (W. E. H.). **Diseases and Pests of Chrysanthemums.**—*Sci. Hort.* **6** pp. 67–71. Wye, Kent, 1938.

This paper includes a brief review of data on the bionomics and control of the principal insect pests of chrysanthemums in England. They comprise *Lygus pratensis*, L., *Phytomyza atricornis*, Mg., *Diarthronomyia hypogea*, Lw., *Psila nigricornis*, Mg., *Brotolomia* (*Phlogophora*) *meticulosa*, L., and cutworms. Reference is also made to thrips as vectors of tomato spotted wilt, a disease that is commoner in chrysanthemums than is generally realised.

Speyer (E. R.). **Pests of the Carnation and their Control.**—*Sci. Hort.* **6** pp. 72–85, 2 pls., 43 refs. Wye, Kent, 1938.

This paper is restricted to pests of carnations grown under glass in England. The principal species dealt with are *Tetranychus telarius*, L., *Tortrix pronubana*, Hb., *Polia oleracea*, L., *Hylemyia brunnescens*, Zett., and various Aphids and Thysanoptera.

Wilson (G. F.). **Pests of commercial ornamental Plants.**—*Sci. Hort.* **6** pp. 102–116, 23 refs. Wye, Kent, 1938.

Brief notes, chiefly from the point of view of control, are given on pests of ornamental plants not dealt with in the two preceding papers.

The insects include *Stephanitis* (*Leptobyrsa*) *rhododendri*, Horv., and *Dialeurodes chittendi*, Laing, on rhododendron ; *Macrosiphum jaceae*, L., on cornflowers ; *Anuraphis tulipae*, Boy., on tulips ; *Dasyneura affinis*, Kieff., on violets ; and *Erythroneura pallidifrons*, Edw., *Tortrix pronubana*, Hb., and *Otiorrhynchus sulcatus*, F., which attack a great variety of ornamental plants. A comprehensive list is given in an appendix of the scientific and popular names of the principal pests of the plants, which latter are arranged in alphabetical order.

Russo (G.). **Primi esperimenti di un nuovo metodo di lotta contro la mosca delle olive.** [First Experiments on a new Method of controlling the Olive Fly.]—*L'Olivicoltore* **14** no. 11 (Nov. 1937) repr. 2 pp., 1 fig. Rome, 1938.

The author states that he has obtained excellent control of *Dacus oleae*, Gmel., on olives in Italy by spraying the trees with a mixture of 3 parts lime-sulphur, 1 part soft soap, 0·5 part copper sulphate, 0·5 part powdered lead arsenate and 3–5 parts clay in 100 parts water and then dusting them immediately with sulphur containing 1 per cent. naphthalene. This treatment gives a coating repellent to the fly and prevents oviposition in the fruits. Three applications were made, in the second half of July, on 20th August, and on 20th September. In the second and third applications, 5 parts lime-sulphur and no lead arsenate were used. In the second half of October, the trees were again dusted with sulphur. Very few olives on treated trees were infested on 1st October, whereas all on untreated trees were. On 7th November, almost all the olives on untreated trees had fallen, but very few were attacked on treated ones. The treated trees also suffered less from attack by *Prays oleellus*, F., *Liothrips oleae*, Costa, *Saissetia oleae*, Bern., *Filippia oleae*, Costa, and fungous diseases. They were in better condition, and their fruits were larger (owing to decreased loss of moisture), but ripening was retarded about 15 days. It is suggested that two applications, one at the end of June or beginning of July and another at the end of August or beginning of September, might suffice. A third, if necessary, might be given at the beginning of October. The trees should then be dusted with sulphur in mid-October.

M. N. **Cause d'insuccesso nella lotta invernale contro le cocciniglie dei fruttiferi.** [The Causes of Failure in Winter Work against Coccids attacking Fruit Trees.]—*Note Fruttic.* **16** no. 3 pp. 38–48. Pistoia, March 1938.

From experiments against Coccids infesting fruit trees in Venetia, Candura has stated that total mortality can be obtained with a single spray of either 5–7 per cent. tar distillate or 4–6 per cent. mineral oil, provided that it is carefully applied when the buds begin to swell. If control is complete, re-infestation of the tree by the carriage of newly hatched Coccids by wind is usually very slow and treatment with tar distillate or mineral oil may not be required for 3 or more years. Complete control, however, requires the use of a reliable preparation, accurately mixed at a concentration that is effective but not injurious to the tree, and very careful and well timed application.

The author recommends the use of a home-made lime-sulphur mixture in the years following that in which tar distillate or mineral

oil has been applied, and states that although home-made lime-sulphur (20°Bé) diluted to 15 per cent. strength has been advocated against *Epidiaspis* (*Diaspis*) *leperii*, Sign., it would fail to kill even 5 per cent. of the scales. A strength of 30–45 per cent. is required, and the application must be made as late as possible, but before the buds open. He has obtained excellent results, especially against *Aspidiotus ostreaeformis*, Curt., with freshly prepared home-made lime-sulphur. He states that *Anthonomus pomorum*, L., attacks only a few blossoms on apple trees treated with tar distillate at the end of March. Some Venetian growers employ this insecticide to repel the weevil, but it is costly and its continued use injures the trees.

[Luk'yanovich (F. K.).] **Лукьянович (Ф. К.). Geographical Distribution of the Flax Weevil,** *Ceuthorrhynchus sareptanus* **Schultze.** [*In Russian.*]—*Plant Prot.* no. 14 pp. 25–39, 1 map, 13 refs. Leningrad, 1937. (With a Summary in English.) [Recd. April 1938.]

[Semenov (A. E.).] **Семенов (А. Е.).** *Ceuthorrhynchus sareptanus* **Schultze. Preliminary Communication.** [*In Russian.*]—*T.c.* pp. 39–49, 7 figs., 1 map.

The second of these papers comprises a detailed account of observations already noticed [*R.A.E.*, A **26** 6] on the bionomics and control of *Ceuthorrhynchus sareptanus*, Schultze, attacking cultivated flax in the province of Krasnoyarsk (western Siberia). The investigations recorded in the first, which were made in the summer of 1936, showed that the distribution of this weevil in western Siberia is closely connected with that of wild perennial flax (*Linum perenne*), which is its chief food-plant. Of specimens of *L. perenne* in herbaria, some from different districts in eastern Siberia and the Russian Far East showed the characteristic injury caused by the larvae of *C. sareptanus*, and it is concluded that its range extends as far east as the valley of the middle Amur. Perennial flax grows under ecological conditions that differ greatly from those of the cultivated long-fibred flax (*L. usitatissimum*). In Siberia, the latter is chiefly grown in the marsh-forest zone, whereas *L. perenne* occurs in elevated steppe and in hilly or mountainous districts with soil more or less rich in minerals. The infestation of cultivated flax in western Siberia was evidently due to the proximity of the fields to districts in which *L. perenne* grows.

[Kozhanchikov (I. V.).] **Кожанчиков (И. В.). Some Data on the Effect of Temperature and Humidity on the Development of** *Phytometra gamma* **L.** [*In Russian.*]—*Plant Prot.* no. 14 pp. 49–61, 11 refs. Leningrad, 1937. (With a Summary in English.) [Recd. April 1938.]

Laboratory experiments showed that the eggs and first-instar larvae of *Plusia* (*Phytometra*) *gamma*, L., can develop at temperatures ranging from 10 to 37°C. [50–98·6°F.] and 9°C. [48·2°F.] to 37°C., respectively, and relative humidities of 6–100 and 10–100 per cent. The optimum temperatures, at which mortality in both stages was lowest, were 20–30°C. [68–86°F.], and the optimum humidities were 30–100 per cent. for the eggs and 90–100 per cent. for the larvae. The egg stage lasted 1·5 days at 30°C. and 15 days at 10°C. At 100 per cent. humidity, the first larval instar lasted 1·5 and 12 days at

these temperatures, but low humidity considerably retarded development. Larvae of the other four instars and prepupae were able to develop at temperatures ranging from 10 to 34°C. [50–93·2°F.], the optimum being 22·5–30°C. [72·5–86°F.] and 90–100 per cent. humidity. The duration of their development varied greatly. The pupal stage lasted 5 days at 30–32°C. [86–89·6°F.] and 35 days at 10°C. The optimum temperature and humidity for the pupae were 25°C. [77°F.] and 90–100 per cent., though development was possible at 10 or 32·5°C. [50–90·5°F.]. Pupae were more resistant to dry conditions than larvae. Prolonged exposure to temperatures below the threshold of development (but above 0°C. [32°F.]) killed the larvae, prepupae and pupae, but the eggs withstood exposure to low temperatures for several months.

The temperature sum for the whole life-cycle of *P. gamma* was found to be 515 day-degrees C. [927F.], this figure including the 44 [79·2] day-degrees necessary to complete the sexual maturation of the females. The thresholds of development were 6°C. [42·8°F.] for eggs, 5°C. [41°F.] for first-instar larvae, 9°C. [48·2°F.] for older larvae, 7°C. [44·6°F.] for prepupae and 10°C. [50°F.] for pupae. No diapause has been observed in any stage of the moth.

The fecundity of the females varied greatly, a maximum of 1,421 eggs being laid by a moth from a pupa kept at 25°C. [77°F.].

The geographical distribution of *P. gamma* is reviewed. It occurs under a wide range of climatic conditions, being found, though in small numbers, even in dry and semi-desert areas. The number of generations a year varies from 1 or 2 in Leningrad to 4 or more near Odessa and in south-western Kazakstan.

[Nikol'skiĭ (V. L.).] **Никольский (В. Л.).** *Lethrus apterus* **Laxm. as a Pest of Seedling Trees.** [*In Russian.*]—*Plant Prot.* no. 14 pp. 61–69, 2 figs., 29 refs. Leningrad, 1937. (With a Summary in English.) [Recd. April 1938.]

In 1935, the Geotrupid, *Lethrus apterus*, Laxm., destroyed about 86,000 cherry seedlings (97 per cent. of the number planted) in a tree nursery in the Province of Voronezh. The beetles kill the seedlings by cutting the stems in two ; they also gnaw off the shoots of young transplanted trees, crawling up the stem to a height of 2 ft. They chiefly occur in heavy soil, and avoid sandy or loose soil. In the nursery, they were abundant in the compact edges of the beds and in the paths between them. The overwintered adults appear soon after the snow has melted and live till June or July. They make burrows about a foot long in the soil and, after pairing, store food consisting of material gnawed from plants, in cells at the ends of the burrows. The females oviposit close to the cells, and the larvae hatch in 10–12 days and feed on the stored food. Pupation takes place in August, and the young beetles hibernate in the cells. The life-cycle from egg to adult is completed in 3–4 months. Measures recommended for control are cultivation of the soil, destruction of the burrows and beetles in mid-May, and the application of sprays or dusts to the seedlings and other low-growing plants in April and early May. An effective spray is 2–2½ lb. Paris green in 100 gals. water. The beetles carry poisoned plant material into their burrows, and the larvae are thus killed.

[Ivanova (N. A.).] **Иванова (Н. А.). Methods of testing the Effectiveness of Mineral Oils on the Eggs of the Apple Sucker,** *Psylla mali*. [*In Russian.*]—*Plant Prot.* no. 14 pp. 69–72. Leningrad, 1937. (With a Summary in English.) [Recd. April 1938.]

When testing oil emulsions against eggs of *Psylla mali*, Schm., on apple in 1932–33, the author found that the percentage of eggs that do not hatch does not indicate the full effectiveness of the spray. It appeared that the oil is not a true ovicide, since, as a rule, it does not stop the development of the embryo, and that its effect is due to its softening the chorion of the egg and rendering it elastic, so that the nymph is either unable to hatch, or is so exhausted in doing so that it fails to survive the few days of starvation before the buds open or is too weak to feed. Moreover, some of the nymphs are killed at the time of hatching by coming into contact with the oil film on the egg and the plant. This hypothesis was confirmed in experiments in Voronezh in 1936, as infestation by nymphs of *P. mali* was negligible on apple trees that had been sprayed with an oil emulsion, although 66 per cent. of the eggs had hatched.

[Vinokurov (G. M.).] **Винокуров (Г. М.). The Ploughing under of Egg Masses as a Control of Grasshoppers. (Preliminary Contribution.)** [*In Russian.*]—*Plant Prot.* no. 14 pp. 95–99. Leningrad, 1937. [Recd. April 1938.]

In experiments in the Province of Omsk in the autumn of 1935 and the spring of 1936, considerable areas of abandoned land infested with egg-pods of Acridids, chiefly the Siberian and the dark-winged grasshoppers [*Aeropus sibiricus*, L., and *Stauroderus scalaris*, F.-W.], at the rate of about 13 pods per sq. yard, were ploughed to depths of $4\frac{1}{2}$ or 8 ins. On deeply ploughed land with low vegetation the numbers of grasshoppers that hatched were 84–92 per cent. less than on unploughed plots. None hatched in parts of the ploughed area that were turned into clean fallow or in which vegetables or cereals were cultivated. Deep ploughing of land with tall vegetation (on which the layer of the soil is not completely turned over and most of the egg-pods remain near the surface) and shallow ploughing did not reduce the hatching of the grasshoppers to any appreciable extent. Special experiments, in which egg-pods were placed in the soil at different depths in mid-May and examined in mid-June, showed that the grasshoppers hatch at depths of 2 and 4 ins. and make their way to the surface, whereas they do not hatch at a depth of 6–8 ins., though the eggs remain viable. The value of deep ploughing was confirmed in practice when strips of soil some 60–100 yards wide were ploughed round cultivated fields over an area of about 150 acres to separate them from land infested with egg-pods of Acridids. The crops were not attacked, and no grasshoppers emerged in the ploughed strips.

[Volkov (V. F.).] **Волков (В. Ф.).** *Coccinella septempunctata* **and** *Adonia variegata*. [*In Russian.*]—*Plant Prot.* no. 14 pp. 99–101. Leningrad, 1937. [Recd. April 1938.]

In June 1936, *Coccinella septempunctata*, L., and *Adonia variegata*, Gze., completely controlled *Aphis laburni*, Kalt., and *A. gossypii*, Glov., on cotton in the Province of Odessa. Outside the cotton fields, they were particularly abundant in fallow land overgrown

with weeds infested with Aphids, chiefly *A. gossypii*. Observations indicated that the Coccinellids that remained on cotton after the elimination of the Aphids probably fed on the nectar, as they usually kept on the lower surface of the leaves near the nectary, but they also destroyed second-instar larvae of *Loxostege sticticalis*, L., and fourth-instar larvae of *Plusia gamma*, L. Moreover, in laboratory experiments, *C. septempunctata* fed readily on the eggs and larvae of the first four instars of both these moths and on the eggs of other Noctuids. This Coccinellid was also apparently responsible on two farms for the almost complete absence of larvae of *L. sticticalis* on cotton on which the moths had oviposited in large numbers.

[Stark (V. N.).] **Старк (В. Н.). Laboratory Observations on** *Codiosoma spadix* **Hb.** [*In Russian.*]—*Plant Prot.* no. 14 pp. 107–109, 2 figs., 2 refs. Leningrad, 1937. [Recd. April 1938.]

In view of the damage caused by *Codiosoma spadix*, Hbst., to woodwork in buildings in Leningrad [*R.A.E.*, A **25** 136], experiments were made to ascertain to what extent it would attack the wood of 15 different species of trees. For this purpose, the weevils were confined between two sheets of glass in holes made through small pieces of board and were kept at 18–20°C. [64·4–68°F.] and a relative humidity of 90 per cent. Pine and spruce were freely infested, but wood of deciduous trees was attacked very reluctantly, though birch, aspen, lime [*Tilia*] and willow were injured more than other species. The readiness with which the weevils attacked the wood increased with the degree to which it was decayed, but oak and ash were not infested in any experiment. The wood of stunted pines from sphagnum bogs, which contained much resin, was much less attacked than that of pines from better situated forests. The weevils died in 10–15 days when the moisture content of the wood was only 20 per cent., and fed very little and did not oviposit when it was less than 45 per cent. Damage to the wood was greatest when its moisture content was over 80 per cent., and the weevils were not affected by complete saturation of decayed pine, and continued to develop even in the presence of free water in the galleries. Keeping the wood dry is, therefore, the best means of control.

[Voĭtenko (M. P.).] **Войтенко (М. П.).** *Heliothrips haemorrhoidalis* **Bouché and its Control.** [*In Russian.*]—*Plant Prot.* no. 14 pp. 112–113. Leningrad, 1937. [Recd. April 1938.]

Heliothrips haemorrhoidalis, Bch., is widely distributed in the Azov-Black Sea Province, Georgia and Adjaristan, where the climate is favourable for it and where it breeds in large numbers in neglected greenhouses and is carried from them into gardens and parks. In Sukhum, it is common on a great variety of trees and shrubs, including avocado, orange and persimmon. The adults and larvae infest the leaves, causing them to turn yellow or silver and drop. Eggs are deposited in the under side of the leaves. Hibernation occurs in the adult and the egg stages, the adults sheltering in cracks in the bark or under fallen leaves and lumps of earth. There are 2 or 3 generations a year, the last, which occurs from mid-August to the end of September, being the most numerous. The control measures recommended are thorough spraying of the infested plants 2 or 3 times at

intervals of 10 days with 0·5 per cent. nicotine sulphate or anabasine sulphate in 1 per cent. soap solution or with oil emulsion, dusting with sulphur, keeping the greenhouses clean and fumigating them 2 or 3 times a year with calcium cyanide, burning fallen leaves and débris, and digging the soil under the trees to a depth of 8 ins. to destroy the hibernating thrips.

[Pavlov (I. F.).] **Павлов (И. Ф.). Chemical Methods for controlling the Pea Aphis in 1935.** [*In Russian.*]—*Plant Prot.* no. 14 pp. 113–115. Leningrad, 1937. [Recd. April 1938.]

In field experiments against the pea aphis [*Macrosiphum onobrychis*, Boy.] on peas in the eastern part of the Province of Voronezh in 1935, no difference was observed in the effectiveness of dusts containing anabasine or nicotine. Complete mortality of the Aphids was obtained on the fifth day after applying 5 per cent. dusts at the rate of 90 lb. per acre, but 3 per cent. dusts at the same rate or 7 per cent. dusts at 45 lb. per acre were much less effective. The cabbage aphis [*Brevicoryne brassicae*, L.] proved to be more susceptible, as 3 per cent. anabasine dust at the rate of 63 lb. per acre killed 90 per cent. of the Aphids on seed cabbage, and a second application 8 days later killed the remainder.

[Éĭdel'man (Z. M.). **Эйдельман (З. М.). Study of the Effect of Crude-oil Emulsions on Plants.** [*In Russian.*]—*Plant Prot.* no. 15 pp. 15–34, 9 graphs, 24 refs. Leningrad, 1937. (With a Summary in English.) [Recd. April 1938.]

This is a summary of the results of investigations in 1934 and 1935 on the effect of mineral oil emulsions on the physiology of *Citrus* and apple trees. Some of the information has already been noticed [*R.A.E.*, A **24** 705 ; **25** 131, 156]. The application of highly refined oil of low viscosity did not decrease the process of photosynthesis in the leaves of mandarin orange, whereas refined oil of low viscosity (1·5 Engler) reduced it rapidly and considerably. The penetration into the leaves of considerable quantities of the chemically active substances contained in unrefined oils increases the intensity of respiration, which is detrimental to the plant since it results in an increased expenditure of stored organic substances such as carbohydrates. Special observations showed that the shedding of the leaves of mandarins is caused by a sharp drop in the intensity of such physiological processes as photosynthesis and transpiration, which takes place if the oil contains toxic substances and they are able to penetrate quickly into the tissues of the leaves. If the disturbance is gradual, there is little or no shedding . The leaves of *Citrus*, unlike those of deciduous trees, become separated from the tree at the juncture of the blade with the petiole along the line of several rows of small cells, the presence of which possibly accounts for the easy shedding of the foliage. Investigations indicated, however, that the shedding is not connected with any local effect of the particles of oil at the juncture of the leaf blade and petiole, but is the result of physiological disorganisation in the whole leaf.

[Gilyarov (M. S.).] **Гиляров (М. С.). Field Method for estimating the comparative Attraction of different Crops for Soil Pests.** [*In Russian.*]—*Plant Prot.* no. 15 pp. 56–60, 2 graphs, 4 refs. Leningrad, 1937. (With a Summary in English.) [Recd. April 1938.]

The method described was tested in central Ukraine by determining the comparative attractiveness to soil pests of lucerne, barley, beet, buckwheat, beans (*Phaseolus*) and clean fallow. Each was tested against each of the five others in pairs, so that 15 plots in all were required. Each plot measured 4 by 5 metres, and every alternate square metre in both directions was occupied by one of the two crops (or fallow) to be tested. The experiment was repeated three times. As the initial infestation by soil pests of the squares on a given plot would not vary, their subsequent infestation would depend solely on the attractiveness of the plants. These were sown in late March or early April, and the degree of infestation was ascertained in August by taking a soil sample from the centre of each square. The effectiveness of the method was proved by the fact that the pests known to prefer a given crop concentrated in the corresponding squares ; thus, larvae of the beet weevil, *Cleonus* (*Bothynoderes*) *punctiventris*, Germ., congregated under beet and were practically absent under lucerne, etc., and larvae of the Carabids, *Harpalus* sp. and *Amara* sp., which feed chiefly on the roots of cereals, were most abundant under barley. No preference for any particular crop was shown by wireworms or false wireworms, of which *Agriotes gurgistanus*, Fald., *A. sputator*, L., *Omophlus* spp., and *Opatrum sabulosum*, L., were the most common ; but these species, which are saprophagous, were most numerous in the clean fallow, as the soil there was more moist and contained more humus than that in squares carrying vegetation, which absorbed the moisture. In the absence of clean fallow, they were invariably more abundant in parts of the plot with more humid soil [*cf. R.A.E.*, A **26** 72, 200]. Of the Lamellicorn larvae, *Pentodon idiota*, Hbst., and *Anisoplia austriaca*, Hbst., which are mostly saprophagous, chiefly occurred in clean fallow, whereas *Amphimallus solstitialis*, L., which is phytophagous, mainly infested barley or lucerne.

[Dirsh (V. M.).] **Дирш (В. М.). Experiments on the Use of *Trichogramma evanescens* Westw. in controlling the Apple Borer in the Crimea.** [*In Russian.*]—*Plant Prot.* no. 15 pp. 69–80, 2 graphs. Leningrad, 1937. [Recd. April 1938.]

A detailed account is given of an extensive experiment on the use of *Trichogramma evanescens*, Westw., against the second generation of the codling moth [*Cydia pomonella*, L.] carried out in 1935 in apple orchards in a locality in southern Crimea. Liberations were made between 16th July and 12th August, cards bearing parasitised eggs of *Sitotroga cerealella*, Ol., being pasted inside the covers of match boxes and tied to the branches of the trees. The parasites were released at the rate of 3,000 per tree in batches of different sizes and at different intervals of time. The most satisfactory method was that in which 2,000 were liberated at the beginning of mass oviposition by the moth and 1,000 fifteen days later ; this decreased the infestation of different varieties of apples (in comparison with controls) by a mean of 41·6 per cent.

No relation was found between the variety of apple and the rate of parasitism of the eggs of *Cydia*. It appears to be advisable to liberate a greater number of parasites on trees with large or divided crowns or when the weather is unfavourable. It was found that, all other conditions being equal, the number of apples infested by larvae of *Cydia* is higher, and the percentage infested is lower, on trees that are bearing well, each additional 100 apples per tree corresponding to an extra 21–22 larvae ; and also that the percentage reduction of infestation resulting from release of *Trichogramma* is greatest on trees on which the percentage of apples infested is high.

[Vinokurov (G. M.).] **Винокуров (Г. М.). A simplified Method of observing Areas infected with Locust Eggs. Preliminary Communication.** [*In Russian.*]—*Plant Prot.* no. 15 pp. 80–83. Leningrad, 1937. (With a Summary in English.) [Recd. April 1938.]

Official instructions in the Russian Union for estimating the abundance of egg-pods of Acridids give the area of the sample plots of soil to be examined as 0·25 sq. m. and require 10 samples from an area of 25 acres and 5 more for each additional 25 acres of a homogeneous area. In comparative tests carried out in 1936 in the Province of Omsk (western Siberia), however, the author obtained the same indices of infestation when these instructions were followed and when the area of the sample plots was reduced to 0·1 m. and only 10 samples were taken from homogeneous areas of up to 250 acres.

[Spasskiĭ (A. F.).] **Спасский (А. Ф.). A Machine for Preparation of Dusts.** [*In Russian.*]—*Plant Prot.* no. 15 pp. 86–89, 1 fig. Leningrad, 1937. [Recd. April 1938.]

A description is given of a power-driven machine for mixing insecticidal and fungicidal dusts with each other and with carriers, and for impregnating them with oil or liquid fumigants.

[Gilyarov (M. S.).]. **Гиляров (М. С.). Dry Fixation of the Shape and Colour of Soil Pest Larvae.** [*In Russian.*]—*Plant Prot.* no. 15 pp. 95–96. Leningrad, 1937. [Recd. April 1938.]

To prepare specimens of the larvae of Elaterids and Tenebrionids so as to preserve their shape and colour, the anal aperture of the larva is pierced with a dissecting needle and the organs with their contents expressed on to filter paper. The skin is then dried on a dissecting needle over a spirit lamp. The vapours that form in it restore the natural shape of the larva, and its colour is preserved.

The larvae of Lamellicorns and Longicorns are killed with chloroform or ether, after which the edges of the anal aperture are slit with a lancet and the contents of the body cavity pressed out. The skin is then washed internally 2–3 times with 10 per cent. acetic acid by means of a thin pipette, and then 5–6 times with alcohol, starting with 70°and finishing with 96°. Each time, the alcohol is left in the skin for about 10 minutes. The skin is then washed 2–3 times with chloroform, blown out, and filled with a saturated solution of paraffin wax in chloroform. When the chloroform has evaporated the process is repeated until enough wax has settled on the inner walls of the skin

to prevent it from collapsing. The skin is then filled by means of a pipette with melted paraffin wax, to which it is advisable to add powdered chalk.

[Yakhontov (V. V.).] **Яхонтов (B. B.). A Note on *Heliothrips haemorrhoidalis* Bouché.** [*In Russian.*]—*Plant Prot.* no. 15 p. 99. Leningrad, 1937. [Recd. April 1938.]

In view of a recent record of *Heliothrips haemorrhoidalis*, Bch., as being a new pest of subtropical cultivated plants in Abkhazia [*R.A.E.*, A **23** 572], the author states that it was first recorded from Sukhum as far back as 1901. In addition, it has been observed in the Russian Union in Simferopol (southern Crimea) and on cacao in greenhouses in the Leningrad Botanical Garden [*cf.* also **26** 354].

Tjoa Tjien Mo. **Aanteekeningen over eenige schadelijke insecten op *Hibiscus sabdariffa* (Roselle).** [Notes on some injurious Insects on *H. sabdariffa*.]—*Bergcultures* **11** no. 52 pp. 1850–1852, 3 figs., 4 refs. Batavia, 1937.

Brief notes are given on the bionomics, distribution, morphology and control of 4 moths the larvae of which feed on the leaves of *Hibiscus sabdariffa* in the Netherlands Indies. Females of the Noctuid, *Acontia transversa*, Gn., oviposit on the foliage. The larvae pupate in the soil, and the pupal period lasts 14–16 days. Tachinids were bred from some of the pupae. The larvae of another Noctuid, *Cosmophila* (*Anomis*) *flava*, F., sometimes spin a few leaves together as a shelter. They pupate in cocoons there or between folded leaves. The egg, larval and pupal stages last 3–4, 14–18 and 7–8 days, respectively. The larvae of both species may be controlled by hand collection, or by a 2 per cent. lead arsenate spray. The larvae of a Tineid, *Onebala hibisci*, Staint., and of a Lymantriid, *Porthesia virguncula*, Wlk., do not usually necessitate control measures. The former spins leaves together as a shelter in which it feeds, and both pupate in cocoons between spun leaves. The larval and pupal stages of *O. hibisci* lasted 15 and 8 days, respectively, and those of *P. virguncula* 29–35 and 13–14 days. A Chalcid parasite was bred from one larva of the former. Young parts of *H. sabdariffa* are attacked by an unidentified species of *Empoasca* that causes leaf-curl.

Hutson (J. C.). **Report on the Work of the Entomological Division.**—*Adm. Rep. Dir. Agric. Ceylon 1936* pp. D22–D28. Colombo, December 1937.

The insect pests in Ceylon noticed in this report for 1936 include the following species that have not been recorded recently [*R.A.E.*, A **23** 72; **24** 102, 734]: *Leucopholis* (*Lepidiota*) *pinguis*, Burm., the larvae of which seriously damaged young rubber plants; *Parnara mathias*, F., on rice; various species of Acridids on *Eleusine coracana*; *Dacus cucurbitae*, Coq., *Ceratia* (*Aulacophora*) *cincta*, F., *Plusia peponis*, F., *Aspongopus janus*, F., and *Leptoglossus membranaceus*, F., on cucurbits; *Epilachna vigintioctopunctata*, F., on tomato, *Momordica charantia*, and egg-plant (*Solanum melongena*); *Margaronia caesalis*, Wlk., on *Artocarpus integer*; *Tabidia aculealis*, Wlk., and *Cylas formicarius*, F., on sweet potato; *Myllocerus discolor*, Boh., on *Gliricidia maculata*;

Dorylus orientalis, Westw., in ginger rhizomes; *Lema fulvicollis* [*sic* ? *fulvicornis*, Jac.] on turmeric; *Chionaspis vitis*, Green, and *Pronomeuta sarcopis*, Meyr., on *Hydnocarpus wightiana*; *Dichocrocis punctiferalis*, Gn., on ginger and turmeric; *Zeuzera coffeae*, Nietn., *Achaea janata*, L., *Tiracola plagiata*, Wlk., *Orgyia* (*Notolophus*) *postica*, Wlk., *Euproctis* (*Nygmia*) *flava*, Brem., and *Eupterote geminata*, Wlk., all on castor [*Ricinus communis*]; *Xyleborus arquatus*, Sampson, in stems of *Berberis nepalensis*; *Brachytes bicolor*, Westw., on young shoots of *Asparagus falcatus*; and *Nodostoma bituberculatum*, Jac., and *Euproctis flava* on roses. *Schleichera trijuga*, which is used as a host tree for lac [*Laccifer lacca*, Kerr], was attacked by *Leptocoris* (*Serinetha*) *augur*, F. *Tessaratoma javanica*, Thnb., *Acrocercops tenera*, Meyr., *Thalassodes quadraria*, Gn., *Cleora* (*Boarmia*) *acaciaria*, Boisd., and *Apoderus tranquebaricus*, F.

Pests recorded on *Citrus* for the first time in Ceylon were the Cetoniid, *Heterorrhina elegans*, F., *Orthacris filiformis*, Bol., *Tiracola plagiata*, Wlk., and the Pentatomid, *Scutellera perplexa*, Westw. (*nobilis*, F.); the last two species probably migrated to *Citrus* from castor. Previously recorded pests included *Agrilus mediocris*, Kerr., *Pulvinaria cellulosa*, Green, *Leptoglossus membranaceus*, F. [**25** 299], *Dasynus* (*Pendulinus*) *antennatus*, Kby., *Riptortus pedestris*, F., and *Halyomorpha picus*, F.; the last three species were unusually abundant but did not cause any serious damage. New records on other fruit trees were *Phenacoccus iceryoides*, Green, on mango leaves, and *Dacus ferrugineus*, F., in fruits of guava.

Damage to coconuts by *Nephantis serinopa*, Meyr., decreased steadily throughout 1936 [*cf.* **24** 765]. Breeding of its pupal parasite, *Trichospilus pupivora*, Ferrière, has been continued; pupae of *Tirachola plagiata*, Wlk., were very suitable for this purpose. By the end of 1936, about 350,000 parasites had been bred at Peradenyia and Batticaloa, the life-cycle being completed in 15–23 days, and about 315,000 had been liberated in the latter locality. They were recovered in small numbers early in 1936, but none was found later when the host had almost completely disappeared. *T. pupivora* is the predominant parasite of *Nephantis* in the western coconut areas, but has never become naturally established in the eastern coastal districts, probably owing to the unfavourable climatic conditions prevailing for about 8 months of the year.

In experiments on the control of *Stephanoderes hampei*, Ferr., [*cf.* **25** 333], fumigation with turpentine [*cf.* **21** 424] or carbon bisulphide killed all stages in seed coffee and subsequent germination was satisfactory, but hydrocyanic acid gas was not effective. Experiments indicated that it is unlikely that the beetles can breed in dry market coffee, but adult females can live in it for a maximum of about 4 weeks. In investigations on the parasites of *Dacus* spp. (of which the common species in Ceylon are *D. cucurbitae* on cucurbits, and *D. ferrugineus* on *Citrus* and other fruits), it was found that *Opius fletcheri*, Silv., and *Biosteres* (*O.*) *longicaudatus*, Ashm., were present in sufficiently large numbers to justify an attempt to export them to Hawaii. This work was done in connection with a visit by Hadden [*cf.* **25** 792], who brought to Ceylon the pupal parasites, *Spalangia* sp. parasitising *D. ferrugineus* in Malaya, and *Dirhinus auratus*, Ashm., parasitising *D. cucurbitae* in South India. Several thousand adults of these two species have been reared and liberated in areas planted with cucurbits and *Citrus*.

Lester-Smith (W. C.). **Report on the Work of the Division of Plant Pest Control.**—*Adm. Rep. Dir. Agric. Ceylon 1936* pp. D35–D43. Colombo, December 1937.

An account is given of routine work in 1936 connected with the declared pests of crops in Ceylon [*cf. R.A.E.*, A **25** 221]. The pests of tea were *Xyleborus fornicatus*, Eichh., which was found on 17 new estates, nettle grubs (Limacodids), outbreaks of which affected a rather larger area than in 1935, and *Homona coffearia*, Nietn., infestation by which increased in 7 districts and decreased in 7 others. The incidence of *Oryctes rhinoceros*, L., on coconut was comparatively high, but *Rhynchophorus ferrugineus*, F., caused serious damage only in a few cases where both species were present. *Nephantis serinopa*, Meyr., occurred on coconut mainly in the Eastern Province, but decreased in the latter part of the year [see preceding abstract]. *Cosmopolites sordidus*, Germ., and *Odoiporus longicollis*, Ol., were not recorded on banana from any of the main centres of production. *Stephanoderes hampei*, Ferr., is still increasing its range, and now occurs in all but one of the districts in which coffee is being grown to any extent. It is so widespread that it is thought that the only means of reducing its incidence is the enforcement of a close season for coffee throughout the whole of the affected area.

Ramakrishna Ayyar (T. V.) & Ananthanarayanan (K. P.). **Kole Cultivation of Rice in the Malabar Coast, with special Reference to Insect Pests**—*Madras agric. J.* **24** no. 12 pp. 430–435. Madras, December 1936. [Recd. March 1938.]

Rice cultivated by a special method in lake beds along the Malabar Coast is attacked by a number of the insects that commonly infest it in other parts of India, a list of which is given. *Spodoptera mauritia*, Boisd., does considerable damage almost every year, but only occurs once in each crop. Infestation is first noticeable when the plants are 2–3 weeks old. The damage is reduced to some extent by keeping the plots dry for a fortnight and then suddenly flooding them ; the effect of this treatment is increased if the plants are kept completely submerged for 2–3 days and the floating larvae are then swept up with brooms or collected in rafts of brambles or green twigs dragged over the submerged plants. In some seasons, *Leptocorisa acuta*, Thnb., causes very serious damage to the crop at the flowering stage ; it is impossible to control as it breeds in the wild grasses and swamp rice at the edge of the lake.

Bhatta (K. L.) & Narayanan (B. T.). **Report of Work done in Mysore on the insecticidal Value of Plant Fish-poisons and other Forest Products. (From April 1936 to March 1937.)**—Med. 8vo, 25 pp. New Delhi, 1938.

In investigations in Mysore of the insecticidal properties of various plants, many of which are employed as fish-poisons, alcoholic extracts of fruits of *Citrullus colocynthis*, leaves of *Dillenia indica* and fruits and leaves of *Datura fastuosa*, at concentrations of 5 per cent., gave 70–100 per cent. mortality of larvae of *Epilachna* and of various species of caterpillars. Alcoholic extracts of leaves of *Nerium odorum*, bark and leaves of *Ougenia dalburgioides* and *Bassia latifolia*, bark of *Acalypha*

indica, and roots and bark of *Plumbago zeylanica*, mostly at concentrations of 5 per cent., showed considerable toxicity in tests on various caterpillars, and all except *N. odorum* gave 100 per cent. mortality of the most susceptible. Alcoholic extracts of seeds of *Tephrosia candida*, bark of *Mundulea sericea* (*suberosa*), leaves of *Dillenia indica* and *Coccus suberosus*, seeds and leaves of *T. villosa*, seeds, bark and leaves of *Anona reticulata*, leaves of *Aristolochia indica*, bark of *Gendarussa vulgaris*, leaves, stems and fruits of *Citrullus colocynthis* and roots of *Derris elliptica* (grown locally from imported stock) at a concentration of 10 per cent. in most cases, but much less for the seeds and derris, gave 60–100 per cent. mortality of *Coccus* (*Lecanium*) *viridis*, Green, in 3–4 days, in which period the standard insecticides, nicotine sulphate and hongay (*Pongamia glabra*) oil resin soap, both at 2 per cent., gave 80–100 per cent. mortality. *T. candida*, *D. elliptica*, *B. latifolia*, *O. dalburgioides* and roots of *Aristolochia bracteata*, applied as dusts to *Bruchus chinensis*, L., in stored pulses gave 60–100 per cent. mortality in 24–72 hours; the first two both gave 100 per cent. mortality in 24 hours. The dusts were not effective against *Rhizopertha* and *Calandra oryzae*, L.

In small scale field trials, extracts of seeds of *T. candida* and stem bark of *M. sericea* were effective at 2 and 3 per cent. concentrations, respectively, against larvae of *Epilachna* on potato and egg-plant, *Euproctis fraterna*, Moore, on apple, and *C. viridis* on coffee and guava, and at 0·25 and 0·5 per cent. against *Aphis tavaresi*, Del Guerc., on *Citrus*. *T. candida* at 1 per cent. also controlled adults and nymphs of Membracids on *Cajanus indicus*. *M. sericea* and *T. candida* were both effective in 24 hours against *Epilachna*, whereas calcium arsenate required 4 days to give complete mortality. The toxicity of alcohol extracts was preserved by the addition of molasses. At concentrations of 0·066 per cent., suspensions in water of the powdered roots of *Derris elliptica* (harvested after two years) gave 80 per cent. mortality of mango hoppers [*Idiocerus*] in the field; *T. candida* and *M. sericea* were ineffective at low concentrations against this pest. Hongay oil resin soap was equally effective at 1 per cent. Suspensions of *Derris* in water soon lost their toxicity.

An account is given of chemical investigations into the toxic constituents of several of the insecticides. From *M. sericea* a solid was isolated that possessed all the activity of the plant; its properties are described but it was not definitely identified [probably rotenone: *cf. R.A.E.*, **A 26** 36]. The active material in *T. candida* was completely extracted by means of alcohol; a solid and a liquid were isolated that together possessed all the activity of the seeds. Roots of *D. elliptica* grown locally contained 22 per cent. of ether-soluble substances, nearly 7–8 per cent. being rotenone. In biological tests, extracts of *Derris* with ether, boiling alcohol, carbon tetrachloride and cold alcohol were effective in that order. Preliminary tests indicated that the activity of a plant insecticide is not necessarily a function of its ether extract. The toxicity to various insects of extracts of *M. sericea* and *T. candida* made with hot ethyl alcohol, and of *D. elliptica*, made with different solvents, are shown in tables.

New Insect Pest of Maize.—*N. Z. J. Agric.* **56** no. 1 p. 79. Wellington [N.Z.], January 1938.

Several cases of failure in the germination of maize in a district in Hawke's Bay Province, New Zealand, have been caused by a Carabid,

tentatively identified as *Clivina impressifrons*, Lec. In Australia, where this beetle at times gives trouble, the suggested remedy is to dip the seed before planting in a repellent mixture such as thin tar and then in lime dust with which a little Paris green has been mixed. It is thought that this beetle is likely to prove a serious pest in maize seed-beds.

WILLE (J.). · **Informe del Jefe del departamento de Entomologia (años 1933 y 1934).** [Report of the Chief of the Department of Entomology, 1933 and 1934.]—*Mem. Estac. agric. Minist. Fom. Peru* no. 7 pp. 153–217, 8 pls. Lima, January 1935 [? 1937].

This is a report of work on a number of insect pests in Peru in 1933–34, most of which has already been noticed [*R.A.E.*, A **22** 699, 700 ; **23** 16, 115, 360, 663].

KREIBOHM DE LA VEGA (G. A.). **Contribución á la lucha mecánica contro algunos enemigos del algodonero mediante la formación de variedades adecuadas. Informe preliminar.** [A Contribution to the artificial Control of some Cotton Pests by the Production of suitable Varieties. Preliminary Note.]—*Rev. indust. agríc. Tucumán* **27** no. 4–6 pp. 99–103, 3 figs. Tucumán, 1937.

An account is given of the production of a hybrid variety of cotton in Tucumán, Argentina, the type of growth of which is such that arsenical sprays used against *Heliothis armigera*, Hb. (*obsoleta*, F.) and *Laphygma frugiperda*, S. & A., are able to reach the flowers and fruit readily.

COTTON (R. T.), WAGNER (G. B.) & YOUNG (H. D.). **Heavier-than-air Fumigants and their Relation to Methods of Fumigation for Insect Control.**—*Nat. Grain J.* **21** no. 11 pp. 10–12, 1 fig. Minneapolis, Minn., October 1937.

Tests on the fumigation of stored wheat against *Calandra* (*Sitophilus*) *oryzae*, L., with a mixture of carbon bisulphide and carbon tetrachloride (20 : 80) were conducted in closed rectangular concrete tanks, 60 ft. deep and containing (when filled) 6,000 bushels of wheat. Several weeks before each test, tin boxes screened at top and bottom with 30-mesh metal screening were filled with wheat and 30 or more adults of *C. oryzae* were added to each ; the boxes were kept under the best conditions for the development of the weevils until the time of fumigation. This ensured the presence of immature forms. Five boxes were planted at each 15 ft. level in the tank, one at each corner and one in the centre, the last lot being about a foot below the surface of the grain. In the test in which the fumigant was applied to the grain as it was run into the tank, the boxes were placed in position by a man wearing a gas-mask while the grain was actually being fumigated. At the end of each fumigation the boxes were retrieved as the grain was run out of the tank ; the living and dead weevils were counted and the wheat was returned to the individual boxes and incubated for 6 weeks to determine the survival of the immature stages. Fumigations lasted for 72 hours ; dosages of the fumigant mixture given below are for 1,000 bushels grain. In the first three tests the fumigant was applied evenly on the surface of the grain. In

the first test, a dosage of $1\frac{1}{8}$ U.S. gals. was used at a temperature of 72°F. Lethal concentrations penetrated to a level 15 ft. below the surface of the grain, but not to 30 ft. below the surface. The average kill of weevils in all the boxes was only 58 per cent., and immature stages survived in 73 per cent. of the boxes. In the second test, a dosage of only 1 U.S. gal. was applied at a temperature of 92°F. Lethal concentrations reached the lowest level of grain, and 80 per cent. of the weevils in all the boxes were killed. Immature stages survived in 35 per cent. of the boxes. In the third test, a dosage of 2 U.S. gals. at 92°F. was lethal at the lowest level of the bin, the average kill was 95 per cent., and immature forms survived in only 15 per cent. of the boxes. Penetration of the gas evidently proceeded uniformly down through the bin, as the boxes containing living weevils were not all at one level nor immediately above or below one another; possibly accumulations of dust near some of the boxes protected them to some extent from the gas and accounted for the imperfect kill. In the fourth test, a tank of grain at 60–70°F. was treated by spraying the fumigant at a dosage of $1\frac{1}{6}$ U.S. gals. on the grain stream as the tank was being filled; the average kill throughout the tank was 83 per cent. and immature stages survived in 45 per cent. of the boxes. The first and fourth tests show the relative efficiency of the two methods of applying the fumigant at a low temperature, and the first three show that the temperature of the grain is the controlling factor in penetration of the fumigant. It is therefore recommended that the fumigant should be applied to cold grain by spraying or dripping on to the grain stream. If the grain is warm, the fumigant should be applied to the surface.

SWINGLE (M. C.). **Low Temperature as a possible means of controlling the Cigarette Beetle in stored Tobacco.**—*Circ. U.S. Dep. Agric.* no. 462, 8 pp., 3 graphs, 2 refs. Washington, D.C., February 1938. Price 5 *cts.*

An account is given of investigations in Virginia to determine the minimum exposure required for complete control of the cigarette beetle, *Lasioderma serricorne*, F., at temperatures between 10 and 40°F. The methods of obtaining stocks of the insects, the experiments themselves, and the determination of the rate of cooling of bales and hogsheads of tobacco are described.

The following is based on the author's summary: At 36 and 25°, exposures of 16 and 7 days, respectively, gave complete mortality of all stages. The larval stage was in general the most resistant at low temperatures, but the adult and pupal stages were by far the most resistant at 40°. Complete mortality of eggs, larvae, and pupae was given by exposures of 11, 14 and 12 days, respectively, at 30 and 32°, and all eggs were killed in 12 days at 36°. Reference is made, however, to the much greater resistance of the eggs observed by Powell [*R.A.E.*, A **20** 170]. Bales of cigar tobacco placed in a cold-storage room at approximately 10° cooled from 64 to 15° in from $2\frac{1}{2}$ to $5\frac{1}{2}$ days according to the size, shape and covering of the bale. A 15-day exposure was required for the centre of a hogshead of tobacco to drop to 15° in the same chamber. Eggs and pupae in the centre of a bale of Porto Rican filler tobacco wrapped in heavy paper and enclosed in a burlap case, measuring $22 \times 25\frac{1}{2} \times 32$ inches, the initial temperature

of which was 78°, were all killed in 6 days after the bales were placed in cold storage and held at about 13°. Adults in the centre of the same bales were killed in $6\frac{1}{4}$ days, while larvae were all killed in $8\frac{1}{2}$ days.

Progress Reports from Experiment Stations Season 1936–37.—Med. 8vo, iii+129 pp., ill. London, Emp. Cott. Gr. Corp., 1938. Price 2*s.* 6*d.*

The pests of cotton in Africa during 1936–37 are discussed as in previous years [*R.A.E.*, A **25** 359, etc.]. From Barberton (eastern Transvaal), F. S. Parsons, H. Hutchinson and J. Marshall (pp. 26–32) report that continuous recording of incidence of the American bollworm, *Heliothis* [*armigera*, Hb.], on farms in the Barberton, Swaziland, and Magut areas was discontinued as a routine measure, but comprehensive examples of a winter-breeding area, an area in which breeding takes place on weeds and early summer (irrigated) crops and a summer-breeding area were surveyed. This ensured a supply of pupae to provide moth flight data, which showed that the first attack on cotton and other summer crops is due principally to the moths from the second type of area, and that its extent is governed by the earliness of the planting season ; only if rains are exceptionally early will eggs be laid on the summer crops by moths from a winter-breeding area. In view of the almost constant duration of these flights, the fact that the moths begin to oviposit on crops as these come into flower, and the slight variation in the period between planting and flowering, it is possible to estimate fairly accurately what proportion of moths from the second area and possibly from the first will infest the summer crops and when they will do so. There are practically no other food-plants then present in abundance. To ascertain whether the planting of trap-crops increased the total population, a study was made of egg and larval mortality on all such food-plants. Larval survival on maize and ground-nuts appeared to be about 30–50 per cent. lower than on cotton, but on chick pea [*Cicer arietinum*], it is very high. This plant, moreover, is not tolerant of arsenical dusts and loses its attraction quickly if growth conditions are difficult, so that the moths bred on it oviposit on late cotton. Unlike other food-plants, chick pea may be attractive for oviposition in all stages of growth, there is no distinct increase in oviposition when flowering is at its height, and the larvae can mature on the foliage alone. Larvae bred on a purple-flowered variety give rise to small, light-weight pupae and small moths that produce few eggs, but the pupae and moths from larvae bred on a white-flowered variety are as large, and the moths as prolific, as those bred on cotton or maize. On cotton, survival among larvae arising from the first eggs was high, but mortality increased greatly as the season advanced, the percentage of larvae attaining maturity falling from 21 to 0. A study of breeding in the off-season of cotton showed that tomato and cucumber, which constitute 30 per cent. of the crops in the winter-feeding area, contribute few or no moths ; the principal food-plants in this area are pea, marrow and bean. The nutritive value of the food available is a determining factor in survival ; in most cases, access to developed green ovules is necessary for normal metabolism. Tests on the influence on pairing and oviposition of sugar solutions (artificial nectar) as food showed that fertile eggs are not laid unless the moths have food at regular intervals.

Investigations are being continued on the long diapause entered

by a small proportion of the over-wintering pupae of the red bollworm [*Diparopsis castanea*, Hmps.], which maintains the population in the high cotton-growing areas of the Union of South Africa and Swaziland despite the abolition of ratooning and the absence of natural food-plants [**25** 360]. More early oviposition may occur than was formerly thought. It was established that lack of food and water does not have a significant influence on the length of life or egg-laying habits or capacity of the adults. Cotton planted under irrigation early in the warm season developed at the same time as *Cienfuegosia hildebrandti* and its presence only bred an ultimately heavier population ; moreover it grew badly. Cotton planted in April met with similar conditions as it grew little before early spring. The course of larval survival on *C. hildebrandti* and wild cotton was similar to that on plant cotton.

The pupal stage was reached by 3·75 per cent. of the larvae on *C. hildebrandti* and 2·95 per cent. on wild cotton. The main flight of moths from the overwintering pupae occurred between August and 8th January. During this period fruit of *C. hildebrandti* is present, but wild cotton produces little fruit before the end of December, and early season breeding on it is negligible. Eggs are laid in abundance on *C. hildebrandti* from November to April and on wild cotton from January to April, inclusive.

E. O. Pearson (pp. 33–41) reports that the usual immigration of *Dysdercus intermedius*, Dist., to *Sterculia rogersi* took place in late October and November, and in some cases was extremely large. Most of the members of the succeeding generation left the trees on becoming adult. *D. nigrofasciatus*, Stål, appeared in one locality only, and *S. rogersi* is evidently not in its regular food cycle. In both 1936 and 1937, the population of *D. nigrofasciatus* on *Hibiscus calyphyllus* at Barberton rose in November. In 1937, there were peaks of population in late January, late March and early June, probably corresponding to successive generations maturing at intervals of about 8, 9 and 10 weeks, respectively. Young nymphs were scarce after the end of May. Considerable numbers appeared in late September and early October, but these did not reach the fifth instar. The large adult population of November is due to immigration. The same general observations were made on all the herbaceous food-plants. The infestations on cotton are believed to be formed by the accumulation of small dispersal flights of adults from food-plants that are drying up or otherwise becoming unsuitable for oviposition. The possibility of the period between July and the November invasions being passed on *Dombeya rotundifolia* is being investigated. The generation on *Dombeya* developed a little too late to account satisfactorily for the rise in population on herbaceous food-plants in mid-November, but no other possible origin for the flight is seen. Though the season was very wet, with ample wild food-plants, initial infestations by *Dysdercus* of cotton from them were among the smallest on record except in two cases. *D. fasciatus*, Sign., was practically absent from all wild food-plants except for sporadic appearances on *Hibiscus dongolensis* and *H. cannabinus* late in the season. It is practically certain that wild cotton and *C. hildebrandti* are not food-plants of this species. In two cases, at Barberton and Magut, *D. fasciatus* overwintered on cotton and large populations were built up. At Magut, 58,000 adults of *D. fasciatus* were collected in a field of stand-over cotton, marked and liberated at the point of collection between 22nd and 30th March. During the following fortnight, healthy marked stainers were recovered

from plant cotton at places $3\frac{1}{2}$–$9\frac{1}{2}$ miles from the point of release and on various sides of it. The wind was light throughout. An experiment in which adults and fifth-instar nymphs of *D. fasciatus* and *D. nigrofasciatus* collected in fields of stand-over cotton in July, August and September were kept under conditions approximating to those in nature and fed on seed cotton or nectar showed that it is unlikely that many of the adults of *D. nigrofasciatus* that migrate to herbaceous food-plants in November are of the June–August generation, but that the adults that migrate to *Dombeya rotundifolia* in July–September are probably of the June–July generation, that adults probably survive in the late dry season on nectar, that adults of *D. fasciatus* can overwinter in stand-over cotton or fields that have not been thoroughly cleaned, and that this species is very much more resistant to conditions in the dry season than *D. nigrofasciatus*.

J. E. Peat and A. H. McKinstry (pp. 57–61) report from Southern Rhodesia that attack by Jassids was again slight. *H. armigera* was less important than usual. Oviposition on cotton started in mid-January, but remained comparatively light until the end of the third week in February; it reached a peak just before the middle of March and was over by the end of the third week in March. Different plantings of maize were attractive from late January throughout February. Egg-laying on *Dolichos* [*lablab*] was first recorded in mid-January, two months before flowering; it began to increase early in February and was consistently much higher than on cotton. Of more than 6,000 fourth- and fifth-instar larvae of the Sudan bollworm [*Diparopsis castanea*] exposed in field cages in April and May 1936, more than 2,000 gave rise to normal moths between November and March. During the year, a "Cotton Pest Prevention Act" was passed prohibiting ratooning and the leaving of stand-over cotton. Damage by *Dysdercus* spp. was severe and was caused partly by immigration from ratooned and stand-over cotton. At Gatooma, *D. intermedius* was the predominant species. From the end of March, there was an increase in *D. fasciatus*. In April, the total population was about 5,000 adults per acre. *D. superstitiosus*, F., was present in small numbers. Investigations at the Sabi Tanganda estate indicate that serious damage by *Dysdercus* and *Diparopsis castanea* is avoided by planting in late February or early March, but that the crop obtained will probably not be profitable.

A. G. Bebbington and W. Allan report (pp. 62–66) from Mazabuka, Northern Rhodesia, that attack by *H. armigera*, Hb. (*obsoleta*, F.) was very light. Sunflower was added to the plants on which egg-counts were made [*cf.* **25** 362] and proved more attractive than cotton, but less so than maize. Other results agreed with those of previous years. The area in which trials on damage by *Dysdercus* are being made consists of an alluvial grass land surrounded by a rim of fertile colluvial soil, and a belt of transitional soils, succeeded to north and south by the sandy plateaux. A large parent population of *D. superstitiosus* appears in the northern and southern plateaux in September, and an enormous F_1 generation is bred on *Triumfetta* sp. This plant can be almost exterminated by preventing fires, as it is dependent on burning. The F_1 generation migrates when the November rains begin and a large population appears in the southern colluvial area in which Mazabuka is situated. As *Hibiscus trionum*, on which this species usually breeds, was very scarce in 1936–37, the F_2 generation was bred on the fallen seeds of *H. asper* and matured much earlier

than it would have done on *H. trionum*; breeding extended over a short period only and the population decreased rapidly so that the early cotton suffered most. *D. fasciatus* was forced to leave *Thespesia rogersi*, its chief food-plant, early, as flowering was slight and late. In the transitional and plateau areas it bred on *H. asper*, and a large population migrated to cotton. Differences in the amount of damage to cotton in different areas appear to be caused by the variation in the time of ripening of the crops. Population records must be correlated with records of plant development on various soils. Early planting and the use of strains capable of producing abundant flowers on poor soils are suggested.

H. C. Ducker, W. L. Miller and S. T. Hoyle (pp. 103–106) report that *Diparopsis castanea* was extremely injurious at the Station at Domira Bay, Nyasaland. The main source of the infestation was an area on which stand-over cotton had been left. The difficulty of ensuring the completeness of a clean-up is discussed. A cotton plant puller similar to the one used in India [**24** 763] was used with good results. *H. armigera* was also present. *Dysdercus* moved to cotton in February, but there were less than 1,000 individuals per acre until the beginning of May, when there was a rapid increase, particularly in fifth-instar nymphs.

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CONTENTS.

PAGE

AFRICA : Factors affecting Attacks of Sucking Insects on Cotton... ... 316
AFRICA : Work on Pests of Cotton in 1936–37 364
AFRICA, NORTH : The Parasites of *Mayetiola destructor* in Morocco ... 340
AFRICA, NORTH : A Tingid on Fruit Trees in Morocco 340
AFRICA, NORTH : *Cydia pomonella* in Morocco 341
AFRICA, WEST : Records of Cotton Pests in Belgian Congo 315
AMERICA : New Braconids of the Genus *Stantonia* 330
AMERICA : An Index to the Literature of Economic Entomology (*Title only*) 367
AMERICA, NORTH : A Check List of the Jassids (*Title only*) 367
AMERICA, SOUTH : A Study of Plants that yield Rotenone 318
ARGENTINA : A Variety of Cotton easy to spray against Pests 362
AUSTRALIA : The Identity of a Thrips transmitting Spotted Wilt of Tomato 318
AUSTRALIA : The Removal of Spray Residue from Apples 318
AUSTRALIA : Miscellaneous Pests and their Control in New South Wales 334
AUSTRALIA : Pests of Beans in New South Wales... ... ... 334, 335
BELGIUM : Experiments against the Chicory Flies 313
BRAZIL : Diptera with Larvae that attack Coccids 319
BRAZIL : The Species of *Stephanoderes* observed on Coffee... 319
BRAZIL : Records of the Occurrence of *Phthorimaea operculella* 320
BRAZIL : *Loxostege bifidalis* attacking Cotton in São Paulo 333
BRAZIL : A new Genus and new Species of Coccids (*Title only*) 367
BRAZIL : A Catalogue of the Coccids (*Title only*) 367
BRITISH ISLES : Grassland Pests in the Midland Counties 341
BRITISH ISLES : Larvae and Pupae of Tachinids parasitising *Pieris* spp. 342
BRITISH ISLES : *Myzus persicae* and *Hyoscyamus* virus 3 342
BRITISH ISLES : Pests of Flowers and ornamental Plants... 349
BURMA : Work on Forest Pests in 1936–37 338
CANADA : Estimation of the Importance of Injury by the Spruce Sawfly 330
CEYLON : The Establishment of a Braconid Parasite of *Homona coffearia* 337
CEYLON : Infestation of Tea Bushes by *Calotermes militaris* 337
CEYLON : Work on Insect Pests in 1936 ... ... 358, 360
CHINA : Records of Aphids, including a new Species (*Title only*) 367
CZECHOSLOVAKIA : A Noctuid attacking *Typha latifolia* 345
EUROPE : The Distribution of *Leptinotarsa decemlineata* in 1936 (*Title only*) 368
EUROPE, CENTRAL : A Key to Coleoptera injurious in Forestry 312
FIJI : Parasites of *Tirathaba trichogramma* in Taveuni 334
FORMOSA : Insect Pests of Cotton 309
FORMOSA : A Bruchid in Seeds of *Acacia confusa* 310
FRANCE : The Protection of Buildings from Termites 314
FRANCE : A Study of the Biology of the Beet Fly 314
FRANCE : Insects infesting *Acer pseudoplatanus* 316
FRANCE : Observations on *Ceresa bubalus* 343
GERMANY : Pests of Pines in a restocked Area 312
GERMANY : Contact Dusts against *Bupalus piniarius* 312
GERMANY : Susceptibility to *Chermes piceae* of introduced Species of *Abies* 344
GERMANY : *Otiorrhynchus hirticornis* as a Forest Pest 344
GERMANY : Surveys of Measures for controlling *Melolontha* ... 345, 346
GERMANY : A Review of Recent Investigations on *Lymantria monacha*... 346
GERMANY : A Test of Repellents against *Melolontha melolontha* 346
GERMANY : Work on Orchard Pests in the Lower Elbe Districts... ... 346
GERMANY : A Hand-book dealing with Household Pest Control (*Review*) 347
HOLLAND : Instructions for the Spraying of Fruit Trees 343
HOLLAND : Tests of Dusts against *Nygmia phaerrhoea* and *Diprion pini* 347, 348
HOLLAND : *Myelophilus piniperda* and its control on Pines 348
HUNGARY : A Hyperparasite of *Diprion sertifer* 341
HUNGARY : Larvae of *Meloë* infesting Honey Bees 344
INDIA : Lac Cultivation (*Review*) 311
INDIA : Records of the Occurrence of *Cydia pomonella* 340
INDIA : Rice Pests on the Malabar Coast 360
INDIA : The insecticidal Value of Plant Extracts 360
ITALY : *Acarapis* spp. infesting Bees 343
ITALY : A new Treatment against *Dacus oleae* 350
ITALY : Winter Sprays against Coccids on Fruit Trees 350
JAPAN : Sprays against *Lema oryzae* on Rice 309
JAPAN : Excretion by mature Larvae of *Acanthostoma insidiator*... ... 310
JAPAN : Insect Pests of *Camellia* 311
JAPAN : A Sawfly attacking Oak 311
JAPAN : Coloured Illustrations of Fruit Insects (*Title only*) 368
JAPANESE MANDATED ISLANDS : Hispids attacking Coconut 336

CONTENTS—*cont.*

PAGE

KOREA : *Aphis gossypii* on cotton and other Plants 309
KOREA : Oviposition and feeding Habits of *Aiolocaria mirabilis* 310
MANCHURIA : Plants selected for Oviposition by *Cydia glycinivorella* ... 310
MAURITIUS : Work on the Biological Control of *Lachnosterna smithi* ... 316
MAURITIUS : The Question of the Value of introducing *Bufo marinus* ... 317
MAURITIUS : A Programme for Biological Control of *Diatraea venosata* ... 317
NETHERLANDS INDIES : Studies on Populations of *Tribolium* and *Calandra* 311
NETHERLANDS INDIES : The Biological Control of Insect Pests 337
NETHERLANDS INDIES : Insect Pests of *Hibiscus sabdariffa* 358
NEW ZEALAND : A Carabid attacking germinating Maize... 361
PERU : A Report of Work on Insect Pests in 1933–34 362
PORTUGAL : New Coccids on Oaks 315
RUSSIA : The Bionomics and Control of *Apion* spp. on Clover 307
RUSSIA : Effects of Temperature and Humidity on *Plusia gamma* ... 351
RUSSIA : *Lethrus apterus* as a Pest of Seedling Trees 352
RUSSIA : The Effect of Mineral Oils on Eggs of *Psylla mali* 353
RUSSIA : Coccinellids destroying Aphids and Lepidoptera on Cotton ... 353
RUSSIA : Laboratory Observations on *Codiosoma spadix* 354
RUSSIA : *Heliothrips haemorrhoidalis* in the Caucasus and its Control ... 354
RUSSIA : Tests of Dusts against Aphids on Peas and Cabbage 355
RUSSIA : A Method of comparing the Attractiveness of Crops for Soil Pests 356
RUSSIA : The Use of *Trichogramma evanescens* against *Cydia pomonella* ... 356
RUSSIA, ASIATIC : *Loxostege sticticalis* in western Siberia 308
RUSSIA, ASIATIC : The Distribution of *Ceuthorrhynchus sareptanus* ... 351
RUSSIA, ASIATIC : Ploughing to destroy Egg-pods of Grasshoppers ... 353
RUSSIA, ASIATIC : The Estimation of Abundance of Eggs of Grasshoppers 357
RUSSIAN UNION : Studies on *Aonidiella perniciosa* 305
RUSSIAN UNION : Records of the Occurrence of *Heliothrips haemorrhoidalis* 358
U.S.A. : Studies of Spray Deposits on Apples 320
U.S.A. : The Problem of controlling Insects in Flour Warehouses ... 321
U.S.A. : Vegetation Types in Relation to *Eutettix tenellus* in California 322
U.S.A. : Work on Insect Pests and their Control in 1936–37 ... 332, 333
U.S.A. : A new Thrips injurious to Pine 329
U.S.A. : A new Anobiid infesting Books 329
U.S.A. : A Tachinid Parasite of *Samia cecropia* 330
U.S.A. : Experiments on Fumigation of Wheat in Tanks... 362
U.S.A. : Low Temperature for Control of *Lasioderma serricorne* 363
U.S.A. : The Bionomics and Control of Clothes Moths (*Title only*) ... 367
U.S.A. : The Sampling of Populations of *Pyrausta nubilalis* (*Title only*) 367
Ignition Temperatures of Ethylene Oxide and T-Gas in Air 313
Leaves of *Melia* as a Repellent for *Ephestia cautella* 315
Spray Deposits by Weight and Surface Area of Apples 320
Wetting Properties of Mixtures of Sodium Hydroxide with Fatty Acids... 320
A Stirrer for a Laboratory Spraying Apparatus 321
Determination of Pyrethrin I in Insecticides... ... ... 330, 331
Determination of Rotenone in Derris and Cubé 331
The Components and Solubility of Calcium Arsenates 331
Translocation of Derris Constituents in Bean Plants 332
Effects of Nicotine in Insects 332
The Influence of Temperature on the Development of Insects 336
The Identity and Hosts of *Apanteles circumscriptus* 342
The insecticidal Effect of a Dust containing Dinitro-cresol 345
The Effects of Oil Emulsions on Plants 355
A Machine for Preparation of Dusts 357
The Preparation of Specimens of Coleopterous Larvae 357
Observations on Anatomy and Physiology of *Leptinotarsa decemlineata* (*Title only*) 368
Injurious Soil-insects and Soil Cultivation in Ukraine (*Title only*) 368
Papers on Forest Pests in 1936 (*Title only*) 368
Errors in analysing Apples for Lead Spray Residues (*Title only*) 368
Determination of Nicotine on Apples sprayed with Nicotine Bentonite (*Title only*) 368
Nicotine dissolved in Oil as an Insecticide (*Title only*) 368
Studies on Constituents of Insecticidal Plants (*Titles only*) 368
The Risk of Insecticides to Bees (*Title only*) 368

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